Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER AND AMERICAN ELECTRICIAN.

VOL. 58. NEW YORK, SATURDAY, JULY 15, 1911. No. 3.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK.

JAMES H. MCGRAW, President.
HUGH M. WILSON, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.
TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK

EDITOR.....W. D. WEAVER
A. S. M'ALLISTER.....Associate Editor
W. H. ONKEN, JR.....Associate Editor
W. E. KEILY.....Associate Editor
O. H. CALDWELL.....Assistant Editor
G. TISELL.....Assistant Editor
W. T. PEACOCK.....News Editor
S. S. BOIES.....News Editor
FREDERIC NICHOLAS.....Special Contributor
J. R. CRAVATH.....Special Contributor

CHICAGO OFFICE.....1570 Old Colony Building
CLEVELAND OFFICE.....1021 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All other countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue if proofs are desired. New advertisements will be accepted up to noon of Wednesday of the week of issue.

Copyright, 1911, by MCGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1910 *was* 974,750.
Of this issue 17,000 *copies are printed.*

NEW YORK, SATURDAY, JULY 15, 1911.

CONTENTS.

Editorial 141
Federal Suit Against Wire Manufacturers 144
Code of Engineering Ethics 144
Vice-President Mortimer, of St. Louis, Favors Public Service Commissions 145
President Vail Favors Public Utility Regulation 145
Boston Hot-Weather Telephone Service 146
St. Louis Railroad Electrification Report 146
Merger of Chicago Elevated Railways 146
Chicago Subway Hearings 147
Mexican 55,000-hp Hydroelectric Project 147
Motor Drive in a Great Coke-Oven Plant 147
Telephone Situation in Los Angeles 147
Electrical Decorations in Rochester for Convention of Mystic Shriners 148
Meeting of Central-Station Sales Managers 149
Meeting of Heating and Ventilating Engineers 149
Gas Rate Controversy in Chicago 151
Rate Question in Toledo and Cleveland 151
Rate Discussion at Los Angeles. By LeRoy W. Allison 151
Commission News 152
Current News and Notes 154
Erie County Electric System 157
Jordan Street Station of the Utah Light & Railway Company 160
A Few Reasons Why Hydroelectric Development Should Be Encouraged. By Clarence P. Fowler 161
Data of Transmission Lines in Chicago 164
Notes on the Loading of Telephone Cable and Open-Wire Circuits. By Samuel R. Parker and J. Cavers 165
A. I. E. E. Papers and Discussions 169
Free Electric Fan Service for Invalids 171
Economical Electric Truck Service at Boston 172
Municipal Water Pumping by Central Station 173
House of Edison Light at Boston 174
Factory Lighting 174
Fourth of July Celebration in New York 175
LETTERS TO THE EDITOR:
Globular Lightning. By E. LeRoy Gardner 175
Long-Distance Wireless Telegraphy. By John L. Hogan, Jr. 176
Digest of Current Electrical Literature 176
Book Reviews 179
New Apparatus and Appliances 180
Industrial and Commercial News 185
General News 189
Weekly Record of Electrical Patents 195

THE LOADING OF TELEPHONE CIRCUITS.

The recent hot wave, unprecedented in the records of the Weather Bureau for certain sections of the country, has had a remarkable effect in nearly doubling the normal volume of telephone traffic in some of the Eastern cities and towns. The regular telephone subscribers acted as though they could best keep cool by keeping the telephone switchboards hot. It is said that the modern telephone system has rendered possible the modern many-storied office building, by replacing the messengers that would otherwise overcrowd the elevators, so that the telephone is the reincarnate ghost of the displaced messenger boy. Now it may be said that the modern telephone system has substituted talking for walking in the hot-wave intervals of the American summertime. The loading of telephone circuits refers, however, in technical circles, not to the application of additional traffic, but to the application of additional reactance, whereby conversation is enriched in volume and improved in timbre, so as to go further and fare better.

The article which appears this week on page 165, by Messrs. Samuel R. Parker and J. Cavers, deals with certain aspects of the theory of loading telephone circuits by the insertion of reactance coils at uniform distances. It is pointed out that inductance and capacity in a telephone circuit are similar in respect to their property of storing electromagnetic energy without dissipation, but are different in respect to their method of storing energy and to the phase of current with respect to its driving emf. When energy is being stored in capacity the current precedes the emf, but when it is being stored in inductance the current gives precedence to the emf. If the linear reactance of the inductance can be made equal to the linear susceptance of the capacity, the two effects go hand in hand, neither the emf nor the current taking precedence. In general, the linear susceptance of the capacity in a telephone circuit greatly preponderates over the linear reactance of the inductance, especially in cabled wires, so that the circuit must be loaded with a considerable amount of reactance in order to re-establish the balance of power and allow the voltage and current to travel hand in hand.

If, however, the best amount of loading is used for overhead wires in fine, dry weather the circuit becomes overloaded when the insulation falls in wet weather, so that a compromise adjustment of loading has to be used in order to meet average conditions. Moreover, the loading which may theoretically be the most desirable from the standpoint of circuit efficiency may be prohibitively expensive in space or in cost. Incidentally, loading coils might seem to be most effective if devoid of iron cores, owing to the power losses in hysteresis and eddy currents that take place in such cores.

Nevertheless, air-cored coils are relatively so bulky and costly that it is found better to employ iron-cored coils, especially since the principal iron losses occur at frequencies that are high and silvery, while the tones that are needed in commercial conversation are the golden ones, and these are the infra-2000-cycle tones.

An excellent engineering paper on the subject of loading telephone circuits, which is abstracted on page 171, was read by Mr. Bancroft Gherardi at the recent convention of the American Institute of Electrical Engineers. It conveys a great deal of practical information in solution with the minimum of mathematical solvent. It appears that the most recent practice in loading approximately trebles the effective telephonic range with a given type of cable conductor, while it doubles the range on a given type of overhead wire conductor. New York and Philadelphia are already in permanent weatherproof communication by underground loaded cables, while Washington and New York on one side, Boston and New York on the other, are to be brought into similar communication, making telephonic communication possible even from Boston to Washington, by underground cable, in case of need. The projected cable will demand as nearly complete utilization of its conductors as possible, and phantom circuits will not only be used, but also loaded. It is to be the first large application of the phantoming of loaded cable circuits and the loading of phantom circuits. Our readers will remember that an "actual" telephone circuit comprises a going and a return wire, as well as the terminal apparatus. On the other hand, a "phantom" circuit employs a going and a return pair of wires, each such pair being a separate telephone circuit. A phantom circuit is thus the coupling together of two complete telephone circuits into a third, or compound, circuit. The talking on the compound circuit does not affect either of the two component circuits, because the disturbing emfs and currents are oppositely directed in them and so cancel off. Reciprocally, the talking on the component circuits does not affect the compound circuit, which is entirely inclosed within the loop of wire forming the going and returning conductors.

An interesting use is described, in the paper, of transformers at each end of a loaded line, stepping up at the sending end and down at the receiving end, in order to diminish the terminal losses that loading creates. Loading a line has the effect of raising the operating telephonic voltage and diminishing the telephonic current strength, with a reduction of I^2R power losses along the line, in much the same way as raising the voltage on power-transmission circuits. This change in the circuit produced by loading calls for a higher voltage type of generating and receiving apparatus for its most effective utilization. But since it is impracticable to use two sets of subscribers' apparatus, one wound of low resistance for ordinary unloaded lines and the other wound of high resistance for loaded lines, the standard low-resistance apparatus involves some loss or "terminal reflection loss" when used with loaded lines. By introducing transformers, however, at each end of the line these extra losses can be reduced, and they could be entirely avoided if the transformers themselves were perfect.

DEPRECIATION.

The papers and discussion on depreciation before the recent convention of the American Institute of Electrical Engineers in Chicago constitute a valuable addition to the literature on this important subject. The paper by Mr. Henry Floy included a compilation of data which have been used in recent valuation cases. One of the striking features about this table, which showed the rates used in estimates of theoretical depreciation of different classes of apparatus, was the great difference in the figures allowed for like items. It should hardly be necessary to say, but it is nevertheless frequently forgotten, that the rate of depreciation from age and wear is vitally dependent both on the management and the amount and character of service which is exacted from the apparatus. Mismanagement causes rapid depreciation and loss, and this is one of the strongest arguments for the employment of competent men. The methods employed by a poor manager can be changed by a good successor, but there is no easy cure for the excessive deterioration of apparatus which results from mismanagement.

Mr. Bion J. Arnold, in his discussion of this subject, called attention to a fact that is of vital concern in the valuation of property for rate-making purposes. Occasionally it is asserted that public-service companies should be allowed to earn a fair rate of return upon only the depreciated value of the property as it actually exists. As Mr. Arnold indicated, rates on such a low valuation would tend to prevent a company making an investment of money to raise the property up to its best operating conditions. If the property is not in first-class operating condition at the time rate adjustments are made, further investment of capital is necessary, and rates should be sufficient to provide a return not only on the depreciated value, but also on the additional amount required to place the property in condition to furnish good service.

STREAM FLOW AND FORESTRY.

The relation between the flow of streams and the condition of the watersheds with respect to vegetation is one which has been the subject of a great deal of hypothesis, more argument and little thorough investigation. The causes which govern the flow of streams are so complex that a thoroughly scientific study of the situation is extremely difficult. Worse than this, the variables concerned are far from being independent, so that it is extremely difficult to separate from the complicated mass the facts which are dependent on the action of any single cause. A valuable contribution to this subject has recently been made in a *Bulletin* of the University of Wisconsin, by Professor Mead, in charge of hydraulic and sanitary engineering in that institution. While it deals particularly with the rivers of Wisconsin, its conclusions are in a measure applicable to streams in other regions of similar general situation. The conditions which exist in Wisconsin are those in general belonging to a rolling and initially heavy-wooded country, free of mountainous areas. The Wisconsin streams, therefore, have under all conditions a higher de-

gree of steadiness than is found, for example, in the Rocky Mountain country or the Sierra Nevadas, where the watershed is in the main composed of extremely mountainous country. For this reason, too, the effect of deforestation in rendering more unstable the run-off conditions is less severely felt in Wisconsin than it would be in many states of the Union.

Professor Mead has analyzed as carefully as may be the relations between precipitation and run-off as modified by various factors and as causing variations of high and low water. The study is particularly valuable as showing the relations of precipitation and run-off from month to month, a subject on which data are usually scant. Professor Mead, too, investigated the generally forgotten relation between temperature and flow throughout the year, a relation which, although less striking in Wisconsin than it would be in a mountainous country, is still interesting and important. One of the striking facts brought out in the investigation is that extreme flood conditions are due to the concurrence of conditions of temperature and precipitation which are favorable to excessive run-offs, and that no practicable works of man, like drainage works, reservoirs or reforestation, can materially affect the flood peaks on the larger Wisconsin rivers. This seems a reasonable conclusion for streams having relatively large drainage area and running through a comparatively level country in which large storage is extremely difficult and where there is no danger of actual denudation of important parts of the watershed in spite of the very large amount of forest which has been cut. Another important conclusion reached is that the number of concomitant factors governing stream flow are so great and complicated, and their combinations so numerous, that no problem of flow can be solved even approximately without taking into account also the conditions reached under similar circumstances elsewhere. This is not altogether a comforting statement for students of hydraulics, but it seems to coincide with the results of a very large amount of study of the subject made elsewhere.

With respect to the effect of deforestation on the stream flow, Professor Mead takes a somewhat conservative position, to which one would naturally be led by the study of streams on which the effect of deforestation could not be expected to present extreme conditions. He quotes, from a recent report of the State Forester, some startling figures from the San Bernadino Mountains, showing the prodigious rapidity of run-offs in a deforested region, but very properly discounts them with respect to Wisconsin streams on account of the extreme difference between the mountainous headwaters in the first class and the comparatively level drainage area in the second. With respect to the Wisconsin streams, indeed, Professor Mead is highly skeptical as to any material effect from the deforestation which has occurred, stating that in general the cutting in that State has had no material effect either on high-water or low-water conditions or on the regularity of flow, and that if there have been any effects resulting from deforestation, they have been obscured by the concurrent action of the drainage of marshes, the rise of second growth and the clearing of farm lands. He concludes, therefore, that reforestation of the head waters of the Wisconsin streams cannot be expected to improve the hydraulic conditions.

Of course, these statements must not be applied indiscriminately, for the reason stated, and, indeed, as regards some Wisconsin streams, and in particular the important Wisconsin River, the data given in Professor Mead's report are such as to lead to considerable doubt with respect to the validity of his conclusions. He records certain phenomena which, looked at in the large, require a deal of explanation to convince the students of hydraulics that they are in no wise chargeable to deforestation. Pretty accurate records of cutting are available since 1873 in Wisconsin, and for the same period records of precipitation and stream flow on the Wisconsin River are carefully recorded. The cutting of timber even at the earliest date mentioned was large, over 1,000,000,000 ft. It passed 2,000,000,000 ft. in 1881, 3,000,000,000 in 1888, and reached 4,000,000,000 in 1892, since which time, for lack of material, it has somewhat decreased. In 1897 there were more than 3,000,000,000 acres which had been stripped of their forest covering and several million acres more were but partially covered by the dead and dying remnants of the former forest. Over large parts of this area forest fires had swept at least once.

Now the gagings of the Wisconsin River at Portage are given by Professor Mead from 1873 to 1910. If one compares the gagings for the first fifteen years of this period with those of the second fifteen years, or any subsequent fifteen years, the results are at least sufficiently startling to cause a natural inquiry as to whether the effects of deforestation are conspicuous by their absence in this instance. In the first fifteen years, up to the period at which the cutting had passed 3,000,000,000 ft., there were twenty-eight days on which the gage height at Portage was recorded as above 10 ft. There were only four days in this whole period on which the gage record fell below 2 ft., representing somewhat extreme low-water conditions. The next fifteen years, during which the cutting had passed 4,000,000,000 ft. and was beginning to decline for lack of timber, the same gage showed sixty-nine days of flood above 10 ft. It recorded, however, 300 days of water below 2 ft. as against four days in the previous decade and a half. These enormous differences are somewhat chargeable to the fact that 1888 and 1889 were noticeable flood and dry years respectively. But, looking at the tabulated results in any way one pleases, the large fact stands out that the low-water stages in the Wisconsin River have been made more severe and numerous during the latter half of the period covered than during the former half. This may be chance, but it is at least significant that the low-water period should coincide with that in which the destruction of forest was most rapid and widespread. One can only append a question mark to the whole matter until records for much longer periods than those here recorded are at hand, in order to eliminate the effects of any long-period cycles of weather. Until these are available, however, we should hardly wish to advise anyone to cite the Wisconsin River as an example of the innocence of deforestation.

Change in Mailing Date.

Beginning with this issue, the *Electrical World* will be mailed to subscribers two days later in the week than formerly. This change of date will, of course, enable matters of news to be covered two days later in the week of issue.

Federal Suit Against Wire Manufacturers.

On Monday, July 10, forty-two of the men engaged in the manufacture of wire, wire rope and horse shoes, who were indicted on June 29 for entering into alleged combinations and conspiracies in restraint of interstate trade and commerce, appeared before Judge Archbald, of the United States Circuit Court of Appeals, Criminal Branch, sitting in New York, and entered pleas of not guilty. On the following day six others appeared and entered the same plea. Bail in each case was fixed at $1,000. District Attorney Wise stated that he entertained no fear that any of the remaining eighty-three men indicted would fail to plead, their non-appearance at the present time being due to absence abroad. The district attorney asked that the defendants be allowed thirty days in which to file a demurrer or any motion they might desire, but upon protest from counsel, who asked for sixty days, Judge Archbald fixed Sept. 1 as the limit.

International Electrotechnical Commission.

In conformity with the wishes of the Brussels Conference held in August, 1910, the delegates of the British, French and German electrotechnical committees met at Cologne in the middle of May last and accomplished some excellent work.

Prof. Eric Gerard, having presided at the Brussels Conference, at which the subject of nomenclature had been much discussed, was specially invited to attend, so that not only was there a continuity of ideas, but the delegates were entirely free to put forward their particular views. Those present were: Prof. Eric Gerard, president of the Belgian committee; Mr. M. E. Brunswick, delegate of the French commission; Dr. E. Budde, president of the German committee; Dr. Silvanus P. Thompson, delegate of the British committee, and Mr. C. le Maistre, general secretary of the commission.

Before the actual work of the meeting was commenced an important suggestion was outlined by Dr. Budde dealing with the international unification of symbols. On behalf of the German-speaking nations as represented by the Elektrotechnischer Verein of Berlin, Dr. Budde said that they would be prepared to abandon the use of *W* for resistance and adopt *R* if the English-speaking nations, on the other hand, would adopt *I* instead of *C* for current. Dr. Budde was quite ready to exclude *J* as a synonym for *I* owing to the confusion which would arise due to the fact that *J* is already employed to represent other quantities. Dr. Thompson, on behalf of the British committee, willingly concurred in this suggestion, and as the American Institute of Electrical Engineers adopted *I* in 1893, and through the good offices of the American electrotechnical committee the National Electric Light Association of America is being approached in the matter, there is every hope that at Turin the symbols *I, E, R* will be universally adopted. Such a decision if ratified by the commission, as no doubt it will be, will certainly be a most encouraging step in the right direction.

The discussion of the work of the various committees on the German "List of Terms" put forward at Brussels was then entered upon, and a list of some fifty industrial terms and definitions was agreed to in French and English. The qualifying word "industrial" has been introduced so as to distinguish this work from that of the vocabularies in course of preparation by several of the committees. The vocabularies include definitions of a character more abstract and general and more rigidly scientific than is necessary in the case of industrial terms, which are more conventional and can therefore be defined in less academic language and yet prove of value to the industry by facilitating commercial transactions between buyer and seller. As the time at their disposal was so limited, the delegates intend to meet again in Turin early in September so as to have an opportunity of revising their work prior to submitting it to the plenary meeting of the commission. In the meantime the work already carried out is being issued to the various committees for their consideration.

The special committee was much pleased with the work of the Danish committee, which was presented in an admirable manner and was of very considerable assistance to the other committees. The work of the Japanese, the Mexican and the Spanish committees was also most complete.

The small committee has been so successful in its task that in all probability the appointment of other small international committees to study certain particular subjects in a preparatory manner will be considered in the near future, and thus work will be going on continuously and more rapid progress insured than in the case of work in the past.

Code of Engineering Ethics.

The Institute of Consulting Engineers has adopted a code of ethics and a schedule for guidance in determining fees for professional service, as follows:

Code of Ethics.—It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Institute of Consulting Engineers:

(1) To act for his clients in professional matters otherwise than in a strictly fiduciary manner or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause 4.

(2) To accept any trade commissions, discounts, allowances or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, or in connection with any professional business which may be intrusted to him.

(3) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his judgment or the quality of his service to his clients.

(4) To receive, directly or indirectly, any royalty, gratuity or commission on any patented or protected article or process used in work upon which he is retained by his clients, unless and until receipt of such royalty, gratuity or commission has been authorized in writing by his clients.

(5) To offer commissions or otherwise improperly solicit professional work either directly or by an agent.

(6) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of a fellow engineer.

(7) To accept employment by a client while the claim for compensation or damages, or both, of a fellow engineer previously employed by the same client and whose employment has been terminated remains unsatisfied, or until such claim has been referred to arbitration or issue has been joined at law, or unless the engineer previously employed has neglected to press his claim legally.

(8) To attempt to supplant a fellow engineer after definite steps have been taken toward his employment.

(9) To compete with a fellow engineer for employment on the basis of professional charges by reducing his usual charges and attempting to underbid after being informed of the charges named by his competitor.

(10) To accept any engagement to review the work of a fellow engineer for the same client, except with the knowl-

edge or consent of such engineer or unless the connection of such engineer with the work has been terminated.

SCHEDULE OF FEES.—As a general guide in determining fees for professional services, the American Institute of Consulting Engineers recognizes the propriety of charging: *A*, a per diem rate; *B*, a fixed sum; or *C*, a percentage on the cost of work, as follows:

A—Per Diem Rate.

(1) Charges for consultations, reports and opinions should vary according to the character, magnitude and importance of the work or subject involved, and according to the experience and reputation of the individual engineer, from $100 per day to a higher figure, and in addition, where expert testimony is required or where otherwise conditions warrant so doing, a retainer varying from $250 to $1,000 and upward. An additional charge should be made for all actual expenses such as traveling and general office expenses and field assistants and materials, with a suitable allowance for indeterminate items. In such cases six hours of actual work should be considered one day, except that while absent from the home city each day of twenty-four hours or part thereof should be considered one day, irrespective of the actual hours of time devoted to the case.

B—Fixed Sum.

(2) A fixed total sum for above-mentioned services may be agreed on in lieu of per diem charges. A fixed sum may also be charged for a portion or all of the items of preliminary surveys, studies, examinations, reports, detail plans, specifications and supervision, including all of the expenses above recited in (*A*).

C—Percentages on the Cost of Work.

(3) For preliminary surveys, studies and report on original project, or for examination and report on project prepared by another engineer, including in both cases all expenses of every nature except those that may be specifically omitted by agreement—from 1½ per cent to 3 per cent on the work.

(4) For the preliminary stage (3) and in addition thereto detail plans and specifications for construction, including all expenses of every nature except those that may be specifically omitted by agreement—from 2½ per cent to 5 per cent on the estimated cost of the work.

(5) For the preliminary and middle stages (3) and (4) and in addition thereto general supervision during construction, including all expenses of every nature except those that may be specifically omitted by agreement—5 per cent, but more for work costing comparatively small amounts, and from 4 per cent to 5 per cent where the amount involved is considerable.

(6) For full professional services (3), (4) and (5) and management, including the awarding of contracts, and including all expenses of every nature except those that may be specifically omitted by agreement, 10 per cent; but more for work costing comparatively small amounts, and 6 per cent to 10 per cent where the amount involved is considerable.

(7) When desired, the percentage basis may be adopted for one or more stages, supplemented by a daily or monthly charge or fixed sum for the remaining stage or stages.

D—General Provisions.

(8) The period of time should be designated during which the agreed percentages and daily or monthly charges or fixed sum shall apply and beyond which period an additional charge shall be made.

(9) The percentages are to be computed on the entire cost of the completed work or upon the estimated cost, pending execution or completion.

(10) Payments shall be made to the engineer from time to time in proportion to the amount of work done.

(11) When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with negotiations, legal proceedings, failure of contractors, franchises or right-of-way, a charge based upon the time and trouble involved shall be made in addition to the percentage fee agreed upon.

The code of ethics and schedule of fees have been printed in pamphlet form for distribution. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

Vice-President Mortimer, of St. Louis, Favors Public Service Commissions.

In an address before the St. Louis League of Electrical Interests Mr. James D. Mortimer, the new vice-president of the Union Electric Light & Power Company of St. Louis, who is also vice-president of the North American Company, which controls the St. Louis property, said that the creation of public-service commissions with inquisitorial powers can do much in the future, as it has done in the past, to acquaint the general public with the many problems confronting the public-service corporations of to-day and to make the road easier for the corporations to travel, at the same time bettering the quality and lowering the cost of service by avoiding the imposition of burdensome regulations and unjust taxation.

Public-service corporations, he said, welcome regulation, as it will help them place before the public the many problems confronting them, and secure the help of the public in their solution. They feel, however that regulation and politics should be definitely and absolutely divorced. With the creation of public-service commissions in various parts of the country there has been placed in the hands of the ruling political party a most powerful device for perpetuating its reign. By the authority vested in such regulating bodies, such public-service corporations may be imposed upon or the poor man may be unjustly favored, to the end that votes may be made. Where such power is so exercised regulation will, of course, fail to meet the end it was designed to accomplish. Where public regulation has been used for political effect it is most discouraging to the public-service corporations enjoying such treatment; but Mr. Mortimer believes that in the long run things will right themselves and that the right to regulate will be exercised in a manner best for all the parties in interest.

President Vail Favors Public Utility Regulation.

In his annual report for 1910 President T. N. Vail, of the American Telephone & Telegraph Company, stated that public control or regulation of public-service corporations by permanent commission has come and come to stay, and he strongly indorsed the principle of such regulation. Last week he returned to the subject in an interview in Boston and said that he is in favor of the control by the people of the telephone, telegraph, electric-light and railway companies and the railroads.

President Vail advocated public-service commissions elected by the people, or appointed by the President or Congress, as the case may call for. While he is not prepared to say that it is possible under present conditions and with the present state of the interstate commerce law to inaugurate a national utilities commission, he believes this will be the ultimate solution of the problem. He says that he is not afraid, if a body representing the people and elected by them should take up the legal problems which must be met by all utilities, that the latter would suffer in consequence, but he is afraid of the demagogues and unprincipled politicians who would have the people believe that they are continually being cheated by the public-service companies.

While Mr. Vail believes that a national utilities commission will be the ultimate solution of the problem, the supervision of this commission should stop at control and regulation. It should not manage, operate or dictate what

the management or operation should be, beyond the requirements of the greatest efficiency and economy. State control or regulation should be, he says, of such a character as to encourage the highest possible standard in plant, the utmost extension of facilities, the highest efficiency in service and rigid economy in operation, and to that end should allow rates that will warrant the highest wages for the best service, some reward for high efficiency in administration, and such certainty of return on investment as will induce investors not only to retain their securities but to supply at all times all the capital needed to meet the demands of the public. A public-service commission should, Mr. Vail says, confine itself to passing judgment upon matters of justice and fairness, rather than upon matters of technical detail, just as a judge altogether unacquainted with mechanics may hear a patent case and render a decision upon it. Through wise and judicious State control and regulation all of the advantages without any of the disadvantages of State ownership are secured. State control of public utilities, if properly applied, should not prevent progress, and it should be sufficiently unrestricted to encourage the introduction and demonstration of the value of new or novel enterprises, and should allow sufficient reward for the initiative, enterprise, risk and imagination of the adventurers behind such enterprises. It should, however, discriminate between the useful adventurers or promoters and the pirates or sharks who, on the strength of other successses, extravagantly capitalize undeveloped ideas and exchange worthless securities for the savings of the deluded and credulous investors. Corporate control and restriction should always exist to a sufficient degree to prevent such speculative promotion and such stock-jobbing schemes.

Boston Hot-Weather Telephone Service.

During the recent five-day period of unprecedented heat in Boston the telephone service was taxed to the utmost to meet the greatly increased demands made upon the lines. The company met the emergency with great efficiency, the operators staying at their posts and giving excellent service under doubly trying conditions. In some of the exchanges the volume of business was double that of the average day, many business men remaining at home and conducting their business by wire. The operators were supplied at their posts with cool drinks of lime and grape juice, and with the abundance of electric fans the number who succumbed was surprisingly small. President Keller praised the employees for their loyalty under the hard conditions.

To illustrate the increase in calls resulting from the heat, 1900 toll calls were filed at Salem for Boston, as against the high record previously of 1100. To add to the difficulties thunderstorms prevailed in various parts of New England. One seashore residential town did more business in one day than had been done the whole of the week before.

St. Louis Railroad Electrification Report.

A committee on railroad electrification appointed by the Civic League of St. Louis in 1909 to consider the general problem of terminal electrification has submitted its report, giving an outline of its work and the conclusions to which it has been led. The report was drawn up by Prof. A. S. Langsdorf, dean of the School of Engineering at Washington University, who, acting as chairman of the committee, made a special study of the New York terminal electrification for the purpose.

Attention was called to the fact that all of the most important electrifications have been brought about because of the limitation imposed upon steam traffic by the existence of tunnels. These limitations are due to the fact that the smoky atmosphere demands slow speed to insure safety, and that large headway between trains is essential. The feasibility of electrification from a purely mechanical viewpoint has been amply demonstrated by installations now in service. The terminals in St. Louis could be electrically operated, but it must be remembered that such a project is more a financial problem than a technical one, and the ultimate settlement of the issue depends upon a careful balance between the economies that may possibly be effected by the use of modern appliances and the fixed charges on the investment.

The physical conditions in St. Louis differ somewhat from those in Chicago, where terminal electrification has been recommended by the investigating committee; from those in Boston, where the investigating committee urged caution because of the very large cost; and from those in Baltimore and New York, where electrification has been accomplished. In St. Louis there is a union terminal used by all roads entering the city, which fact alone is most favorable to economic operation; the suburban service is now and probably will long remain limited, which fact would tend to confine the electrified zone to the city limits. It was estimated that for the terminal electrification there would be required a 40,000-kw generating equipment, 150 $45,000 locomotives, a $1,400,000 transmission and distribution system and a $1,500,000 signal system, costing, with 10 per cent added for contingencies, about $17,116,000 for 262 track miles, or $65,300 per track mile.

The committee argued that the elimination of the principal grade crossings is necessary on the ground of public safety, and should be completed before electrification is begun. Electrification would eliminate the smoke now contributed by the railroads, which represents about one-third of the entire amount of the city's smoke, and is very desirable as it would increase the comfort and convenience of the traveling public. It does not follow, however, that electrification is the only solution of the smoke problem, it being a fact that fuel-burning locomotives can be so handled as to reduce considerably the volume of smoke and cinders ordinarily emitted. The probable increase in suburban traffic alone would not justify electrification in St. Louis. The money to pay for it might either be diverted from needed additions to terminal facilities or might necessitate increased local freight or switching charges. In either case there would be an added burden upon the manufacturing and commercial industries of the city which should be taken into consideration.

Merger of Chicago Elevated Railways.

The merger of the elevated railway companies of Chicago seems now to be an accomplished fact. The "deposit agreement" for the purchase of the stock of the South Side, Metropolitan and Northwestern Elevated roads was declared to be effective on July 1. An association known as Chicago Elevated Railways has been formed, and it is declared to control all the elevated railways in Chicago, operating about 173 miles of single track

It is believed that the Commonwealth Edison Company sustained an intimate and friendly relation to the merger of the elevated railways. It is reported that in exchange for active assistance in promoting the plan and also as a return for pledging a large guarantee fund for the repayment of money advanced by the banks the Commonwealth company has a virtual contract for furnishing all the electrical energy needed by the combined elevated railways of the city. The central-station company now supplies a large part of the energy used by the "L" roads, but not all of it, and apparently by lending its assistance and credit to the merger plan it has clinched the whole of the business and secured ieself against possible competition.

Furthermore, as the Chicago City Railway Company and the Chicago Railways Company, operating the surface roads of the city, appear to have had a share in the

merger plan, it is likely that one important result of the combination will be that the Commonwealth Edison Company will supply before long all the electrical energy used by both surface and elevated railways in Chicago. It is also declared that Mr. Insull will go on the board of the Chicago Elevated Railways and will share responsibility for the management with Mr. Blair.

There seems to be some question whether the merger of the elevated lines will not entail universal transfers and a single fare. A resolution has been passed by the City Council directing an investigation of the proposed merger.

Chicago Subway Hearings.

The hearings of the local transportation committee of the City Council of Chicago in relation to subway proposals, while perhaps of more local than general interest, are nevertheless of some significance in showing the surprising number of projects presented—some carefully thought out and some fantastic. The latest hearing was held on July 10 and the proposal submitted was that of the Chicago Subway Arcade & Traction Company. This company was organized in 1895 and is the pioneer subway company of Chicago. Mr. Dwight H. Perkins, a director, presented a written argument for a comprehensive subway system rather than a limited subway. Notwithstanding the announced attitude of the city that the subways shall be municipally built and owned, Mr. Perkins asked for a franchise for his company. He promised that private capital to any amount could be obtained.

One feature of the plan provides foundations for the subway that would prevent the settling of adjoining buildings, it is said. An elaborate plan was presented providing for the building of a subway by private capital, but for municipal ownership and control from the first. It is also proposed to connect with surrounding interurban railways. Mr. S. D. Gookins, secretary of the company, followed with an able presentation of the elaborate data and plans which have been prepared by the company. This scheme proposes that a system of 38 miles of subway shall be built at once.

It was announced at the hearing of July 10 that President T. E. Mitten, of the Chicago City Railway Company, had told some of the members of the committee that he was greatly interested in the subway proposals and that he had outlined a plan of his own which he would be willing to lay before the committee if the aldermen cared to hear it. A motion was adopted inviting Mr. Mitten to lay his plan before the committee.

Mexican 55,000-hp Hydroelectric Project.

The Mexico Northern Power Company, which is constructing a great dam across the Conchos River about 22 miles from Santa Rosalia (Chihuahua), Mexico, for the purpose of creating a water-storage reservoir for hydroelectric and irrigation purposes, expects to have the project finished by June, 1913. The construction of this dam was interfered with by the recent revolutionary troubles and for a period of several months only about 400 men were kept at work, but now that peace has been restored the number of laborers has been increased to about 1200. The dam will impound 66,000,000,000 cu. ft. of water in a reservoir 30 miles long and 5 miles to 6 miles wide. The hydroelectric plant will have a capacity of about 55,000 hp, and the electrical energy will be transmitted to Chihuahua, parral, Jimenez, Santa Rosalia and a number of other towns and industrial centers of the State of Chihuahua. The company owns about 200,000 acres of land in the valley of the Conchos River, all of which will be brought under irrigation by means of a canal system which will derive its water supply from the big artificial lake. The cost of the works will exceed $15,000,000. Mr. J. G. McNab, a construction engineer of Mexico City, is in charge of the work. The company is composed of Canadians.

Motor Drive in a Great Coke-Oven Plant.

The Indiana Steel Company has just completed at its Gary plant the first section of the coke-oven equipment producing coke for the blast furnaces and fuel gas for the reheating and soaking furnaces of the mills. In the new coke-oven plant, said to be the largest in the world, all auxiliary operations are performed by motor drive, 6600-volt, energy for which is furnished by the blast-furnace gas-engine power plant. Preliminary to coking motor-driven crushers reduce the coal to a state of powder, in which condition it is hoisted by conveyors to the storage tanks over the retorts. The incandescent contents of the ovens are "drawn" electrically, the coke being discharged into cars which are pulled by 15-ton, 100-hp, three-phase locomotives to the quenching houses. Motor-driven blowers provide the pressure for distributing the fuel gas to the various reheating furnaces and soaking pits in the mill in which it is burned. A complete by-product plant has been installed in connection with the coke ovens for extracting the valuable ammoniacal and coal-tar materials from the gas before burning the latter in the ovens. Coincident with the completion of the coke-furnace plant a duplicate of the original gas-engine power house is being erected near the first station, opposite the line of blast furnaces on the Gary harbor front.

Telephone Situation in Los Angeles.

In a recent address delivered before the City Club of Los Angeles, Mr. Kempster B. Miller, retained as telephone expert by the Board of Public Utilities of that city, made an interesting review of the telephone situation. Los Angeles has two companies, and the competing, or Home, company made the mistake that many Independent companies have made, of charging at first rates that were too low. As a result of neglect to figure on depreciation, many telephone companies have been able to realize large apparent profits in the early stages of their business. But experience shows that a time of reckoning comes invariably in these cases, with the result that such companies have been forced to raise their rates or adopt some other unpleasant alternative.

The statement that the cost of giving service increases proportionately per telephone as the number of telephones increases is too broad to be true, according to Mr. Miller. It does cost more per telephone to give service in a large community, with a large number of telephones, than it does in a small community, with a small number of telephones. In a small town a telephone plant may be built often at a total expense of not more than $40 or $50 per telephone, whereas in a city like Los Angeles the plant will cost from $125 to $150 per telephone. The average length of lines is greater in the larger city, and more costly buildings are required. It is not true, however, as often stated, that with a given plant the cost of giving telephone service goes up per telephone as the number of subscribers increases. The reverse is likely to be true. Plants are ordinarily built for a greater ultimate capacity than their immediate requirements, and as the service is extended the cost per telephone is more likely to come down than to go up.

Mr. Miller said that he found that the exchange business of the Pacific Company (Bell) for the year 1909 resulted in a net profit of about 1 per cent of the estimated reconstruction cost of the plant within the city limits. The speaker made the interesting point that telephone investigations are almost always made on the basis of cost; people do not seem to realize that there is just as much difference in quality in telephone service as there is in price. Los

Angeles has been getting about as good a service as it has been paying for. However, there is a tendency everywhere among the public toward the use of the better grades of the service offered.

The rates suggested by Mr. Miller are somewhat higher than the old ones, and it is estimated that they will result in an increase of revenue of about $90,000 a year to the Pacific Company and about $174,000 to the Home Company. The difference is caused by the fact that the Home Company has been operating, under protest, at lower rates than the Pacific Company.

In relation to interchange of traffic between the two companies, Mr. Miller said that it was quite feasible from a physical point of view, but whether a scheme can be worked out that will be legally and commercially practicable is another matter.

Electrical Decorations in Rochester for Convention of Mystic Shriners.

Rochester, N. Y., was this week in the hands of the Imperial Council, Ancient Arabic Order, Nobles of the Mystic Shrine. Its streets were crowded with men in brilliant Arabic and Oriental costumes and at night its principal avenues were aglow with the light from some 75,000 30-watt incandescent lamps arranged in canopies at street intersections or in festoons from pole to pole on either side of all main avenues leading to the hotel district from the various railroad terminals. The convention began on Tuesday morning with a parade in costume followed by a session in the Convention Hall at which appropriate addresses were made by the Mayor of the city, the Lieutenant-Governor of the State and high potentates of the order. At night there was a grand parade of visiting Temples and Patrols, with brilliant electric illumination on the line of march, including floats lighted by electricity furnished by storage batteries.

Main Street, State Street, St. Paul Street, South Avenue, North and South Clinton Streets, Court Street, Exchange Street, Central Avenue and Mortimer Streets were festooned with lamps and high canopies were suspended from cables at the intersections of the main streets and also between blocks, there being twenty-one canopies in all, each holding 1500 lamps. In addition to these there were numerous emblems of the Mystic Shrine order outlined in light. Every avenue leading into the city had a sign on whose incoming face were the words "Feel-to-hum" and on the reverse side were different phrases such as "Come Again," "Stay With Us" or the name of the Temple in the city to which the road led.

The canopies were put up and paid for by public subscription and will remain in place and be lighted all summer long at a rate of 4 cents per kw-hour. There are numerous other large gatherings scheduled to assemble in Rochester, such as the Grand Army of the Republic next month, so that the canopy effects will suffice for all. The festooning, of which there was over 5 miles, was erected by a Cincinnati contractor at a cost of $6300. The energy for lighting the lamps in the festoons was contributed gratis by the Rochester Railway & Light Company. Many of the buildings were outlined with light in honor of the occasion and the whole city was gay with bunting, flags and other decorations appropriate to the order.

The feature of the week was the Water Carnival on the Genesee River on the evening of July 12. The preparations for this carnival entailed an enormous amount of labor. The illuminated parade consisted of decorated canoes, launches and club floats. These proceeded down the river to a point below the Oak Hill Country Club and then up again to Big Elm Tree Bend.

On July 13 there was a grand reception and ball in the New York State Armory which was the concluding feature of the convention. It is estimated that the decorations all told represented an outlay of over $100,000. Fully 50,000 visitors were in the city from all parts of the United States, Canada, Mexico and island possessions of the United States.

Electrical Fires in Chicago.

An interesting feature of the recent annual report of Mr. William Carroll, city electrician of Chicago, relates to the electrical inspectors' reports on electrical fires in that city during the year 1910. A table is given to show that there were eighty such fires, with a total loss of $37,550, a small amount compared with the total fire loss. Of this amount, one fire caused a loss of $30,000, the cause in this case being the breaking of a lighted portable incandescent lamp, the sparks from which fell into gasoline and oil on the floor. The next largest loss was caused by a fire due to sparks from a defective socket falling on chemicals. This defective socket was suspended over the chemicals by lamp cord extended through a metal hood. The loss was estimated by the inspector at $5,000. In all other cases the loss was comparatively slight.

Of the eighty electrical fires, fifteen were due to low-tension wires short-circuited, nine to motor burn-outs, seven to sparks from motor, five to overheated flatirons, five to wires grounded in conduit, four to low-tension wires grounded, four to defective rheostats, four to lightning, four to short-circuit at fixture outlet, four to breaking of incandescent lamp and the rest to a variety of causes.

Electrical Inspection in Chicago.

An electrical inspector in charge, reporting to the city electrician, with a force of twenty-two other inspectors, constitutes, with clerical assistance, the municipal Bureau of Electrical Inspection of Chicago. The work of the bureau is increasing at the rate of about 20 per cent a year, and in his recent annual report the city electrician makes a plea for additional inspectors.

While the primary object of the work of the bureau is to safeguard life and property, other important benefits are derived by the general public. Safe electrical construction is very closely allied with good engineering practice, and an installation which complies with the high standard required by the city ordinance may be considered in general as an example of high-class workmanship.

When a fire is reported the Bureau of Electrical Inspection consults its records at once to see whether the building is wired for electricity. If it is, a thorough inspection is made to determine whether the fire is due to electrical causes. All serious or fatal accidents due, or thought to be due, to electrical causes are also investigated. A special investigation has been made of fires occurring from electrical causes during the year 1910, to determine what proportion of these fires occurred in buildings wired under the old method, where insulators were not used. Such fires as have resulted from the condition of the wires themselves have been classified into three general classes: A, where wires were run in conduit; B, where wires were installed with concealed knob-and-tube work; C, where wires were not placed on insulated supports. An analysis of the figures obtained shows that the chances for fire occurring in a Class C building are about six to one as compared with a Class A building, and about three to one as compared with a Class B building.

During the year the work of reinspecting old installations was continued, although only one inspector devoted his entire time to the work. A complete reinspection has been made of the Union Stockyards and a great improvement obtained in the electrical work there. The great bulk of the work of the bureau has to do with the inspection of new electrical installations.

Meeting of Central-Station Sales Managers.

The second annual convention of sales managers of a few of the larger Edison companies was held at Briarcliff Lodge, Briarcliff Manor, N. Y., on July 10 and 11. The chairman of the convention was Mr. R. S. Hale, of the Boston Edison company, and other members of the committee in charge were Messrs. E. W. Lloyd, of the Commonwealth Edison Company of Chicago, and T. I. Jones, of the Edison Electric Illuminating Company of Brooklyn. Other delegates present were Messrs. H. H. Winter, of the Seattle Electric Company; L. R. Wallis and E. C. Kimball, of the Edison Electric Illuminating Company of Boston; G. E. Miller, of the Cleveland Electric Illuminating Company; J. D. Israel, of the Philadelphia Electric Company; J. C. McLaughlin and W. K. Handy, of the Potomac Electric Company, Washington; Miss S. M. Sheridan, P. J. Savage and E. L. Crosby, of the Edison Illuminating Company of Detroit; L. F. Philo, of the Union Electric Light & Power Company, of St. Louis; J. F. Becker, L. A. Coleman and D. B. Smith, of the United Electric Light & Power Company, of New York; A. A. Pope and C. A. Littlefield, of the New York Edison Company; T. I. Jones, W. W. Freeman and C. A. Graves, of the Edison Electric Illuminating Company of Brooklyn, and J. F. Gilchrist, of the Commonwealth Edison Company of Chicago.

At sessions on Monday the topics of discussion were "Signs," "Tungsten Lamps," "Customers' Deposits and Credits," "Contract Order Routine" and "Shortening the Time of Installation After Application Has Been Signed." On Tuesday the subjects were "Financing Customers' Investment and House Wiring," "Advantages of National Advertising," "Compensation for Solicitors" and "Electric Rates." The object of the convention is to bring together men who are carrying on the same kind of business in different cities who are not competitors, in order to discuss important problems with which they have to deal.

Meeting of Empire State Association.

A meeting of the Empire State Gas & Electric Association was held at Trenton Falls, N. Y., on June 24, in accordance with the plan to hold meetings throughout the year at different points in the State. The attendance was about 50. The business session was devoted to the discussion of a number of different subjects, including the use of electric or gasoline auto trucks, methods pursued in the extension of mains and the practice regarding non-payment cut-offs. After the conclusion of this session a lunch was served. In the afternoon most of the delegates inspected the power-house of the Utica Gas & Electric Company. Some of the members visited the location where the company may install another dam and reservoir. Mr. J. C. De Long, of the Syracuse Lighting Company, presided at the meeting.

Meeting of Heating and Ventilating Engineers.

The summer semi-annual meeting of the American Society of Heating and Ventilating Engineers was held at the Hotel LaSalle, Chicago, July 6 and 7, with President R. P. Bolton, of New York, in the chair. Following an address of welcome by Mr. George Mehring, of the Illinois Chapter of the society, the president delivered his official address, in which he pointed out some interesting effects on the climate, rainfall and temperature of cities occasioned by the huge quantity of coal burned for heating and power purposes. Data quoted by Mr. Bolton for the city of New York showed that during the year 1909 1,400,000 tons of coal were burned for transportation purposes, 885,000 tons by the lighting companies and 920,000 tons for the production of gas, while 512,000 tons of oil were used for gas enrichment, equivalent to 758,000 tons of coal. The 745 power plants in New York's industrial, hotel and business buildings consume about 2,200,000 tons annually, while 6,380,000 tons are used for domestic purposes in houses, stores and apartments. Adding an appropriate portion for Jersey City, the total equivalent coal consumption in the New York district is thus nearly 19,000,000 tons per year. The combustion of this huge quantity of coal produces about 614,000,000,000 heat units daily, which would add 3½ deg. to the temperature of the amosphere one-half mile in height over the area of New York.

Adding to this the heat from all other sources, including animal heat, friction, etc., enough heat units are available to raise the temperature 1 mile high over the entire area of the city through 5 deg. Fahr. A secondary but objectionable effect of this great emission of heat is upon the rainfall, as is definitely shown by the records of precipitation. Cloudless days have increased in proportion, and a condition is reached where the moisture even when present in the atmosphere is not precipitated as rain, but remains suspended as fog. Examinations of records kept by the New York authorities show that the occurrence of a temperature as low as, or lower than, zero has been of less frequency for many years, and since 1904 has not been experienced at all. Curves illustrating these facts were included in President Bolton's paper, showing by a sort of stair-step diagram that this practical elimination of zero conditions has been brought about by artificial means. The decrease in precipitation during the winter months since 1884 is also shown graphically by a second curve partaking of similar stair-step characteristics. The coal consumption of New York City, concluded the author, is by no means excessive compared with the per capita rate throughout the country. At the present time the majority of domestic heating is effected at a very low percentage of efficiency, and, he added, "We must look forward to better methods for the production of heat as well as for power, especially in great cities, probably by greater concentration in central-station heating plants in place of the wasteful processes of domestic heating and power."

Following the reports of various committees a paper on the subject of "Free Engineering" was presented by Messrs. Perry West and George W. Knight. The authors pointed out that the tendency of large manufacturing companies to furnish free of charge expert technical advice to their customers results in an injustice to practising engineers, who thus suffer a reduction in fees. On the other hand, the manufacturers are put to a large and unwarranted expense which must be borne by them at a loss or else charged for by increasing the price of the equipment or machinery sold.

Mr. Paul P. Bird, former smoke inspector for the city of Chicago, followed with a paper on "Some Phases of Smoke Prevention," in which he discussed the problems of atmospheric pollution met with in Chicago, and the methods by which this free carbon and the soiling of the city can be prevented through intelligent inspection and smoke prevention. During the discussion of a paper later in the meeting Mr. Gifford, of Chicago, recounted that from an air-washing machine delivering 40,000 cu. ft. of air per minute and operated ten hours per day 60 lb. of solid matter was taken every three days. About one-half of this material, he said, was carbon, the remainder being dust, etc., among which pieces of vegetable fiber, peanut shell, coffee, etc., were found, depending upon the location of the installation. Such an air-washing machine removes about 99 per cent of the solid material from the air, said the speaker. President Bolton pointed out that the results of these air-washing installations might also prove excellent gages of the density of smoke in given cities or localities.

Mr. Frank L. Busey read a paper on "A Proposed Basis for Rating House-Heating Boilers and Furnaces" which referred particularly to small and medium-sized installa-

tions of steam and hot-water boilers and warm-air furnaces ranging between 2 hp and 50 hp. Mr. Busey's paper pointed out the unsatisfactory conditions under which this small equipment is now rated with two or three times the capacity which can be developed under normal working conditions. The tests cited were made at the engineering experiment station of the University of Illinois, using coals of various character and quality.

The session of Friday morning was opened with a paper on "The Heating and Ventilating of High-School Buildings in Decatur, Ill." The group of buildings described has its own separate fireproof boiler house, containing three 450-hp high-pressure tubular boilers for burning bituminous coal. Steam from these units operates one 75-kw and one 50-kw turbine-generator set, delivering 125-250-volt direct current for motors and lighting. While these turbines are not as economical as reciprocating engines, said the author, they are operated only when heat is required for the building, so that the production of electricity is carried on virtually as a by-product operation. The noiseless operation, long life and the small space occupied by the turbines, together with the fact that they require no internal lubrication, relieving the boilers of oil, were factors in the selection of these small units. The supply fan for the old building is belted to a 50-hp motor and delivers air to reheating coils in plenum chambers. A 2½-hp motor driving an exhaust fan also locally ventilates through metal ducts all toilet-rooms. All main vent flues can be cut off by compressed-air-operated dampers controlled from the engine-room. Thermostats in the classrooms move mixing dampers, which change the temperature of the air without curtailing its volume. In this way the power of the entire plant is finally directed to warming the most difficult room. In the new building the supply fans, driven by 20-hp belted motors, deliver 120,000 cu. ft. of air per minute. The chemical-laboratory hoods and other places requiring local ventilation are exhausted by an 8-hp motor-driven fan of special corrosion-resisting material. In starting to warm the building in the morning the fresh-air intake can be cut off and the air already within the building circulated in a closed path, effecting an appreciable saving of fuel.

In the absence of the author, Secretary W. W. Macon read a paper on "The Ventilation of the Macy Store, New York," prepared by Mr. D. M. Quay. The author's remarks referred particularly to the ventilating of the sub-pavement levels, which are denied natural sunlight and air. Five hundred persons are now employed in this basement, a number of them being boys and girls fourteen years of age, who are admitted with the full sanction of the New York board of health in view of the healthful conditions now obtaining in the basement. The general sentiment is expressed by visitors' remarks on the purity of air. The atmospheric supply comes from a point above the roof level, being carried down a shaft 12 ft. x 24 ft. in section and through tempering coils, from which it is discharged into the distributing ducts by two pairs of 160-in. steel-plate blowers. On account of the chimney effect of the lofty intake shaft motors 25 per cent heavier than usual had to be provided. The vitiated air from the machinery-rooms, shipping department and other rooms is discharged by motor-driven exhaust fans. The mechanical equipment of the Macy store includes 3000 hp in boilers, four 500-hp and two 300-hp electrical generating units, thirty-two hydraulic elevators, a 25-ton refrigerating and water-cooling system, four escalators, parcel delivery and conveyor system, and a vacuum-cleaning system.

"Street-Car Ventilation" was the title of a paper read by Mr. W. Thorn, who declared that this subject has not received the attention its importance demands, the small windows of the monitor deck being generally relied upon to freshen the air within the car. Several special devices, said Mr. Thorn, have been developed to meet the changed conditions with modern pay-as-you-enter cars having the front platform closed. One general type depends upon the speed of the car for its operation, while the others employ local mechanical draft. The Chicago ordinance requires the supply of 350 cu. ft. of air per hour per passenger, stipulating that this air shall be brought into the car below the heads of the seated passengers and taken out above the heads of the standing passengers. A mechanical system used in that city consists of a motor-driven exhaust fan located on the vestibule roof. An exhaust chamber is formed in the upper ceiling of the car, there being openings at various points in the ceiling and intakes at several points in the floor, where they can be connected to the electrical heaters. The ½-hp fan motor drives a 9-in. cone fan capable of handling 33,000 cu. ft. of air per hour. The size of the eight intakes located under the seats near the electric heaters is arranged for a maximum velocity of about 400 ft. per minute. A number of aspirator systems have been employed, the velocity of the car being used as the source of circulation. Tests have shown that with electric heaters the amount of energy required to heat mechanically ventilated cars is no greater than with deck-window ventilation. The reason for this, said Mr. Thorn, probably lies in the greater efficiency of the heating units when working on a continuous flow of fresh air as against the ordinary practice of placing the heaters in a dead-air space where energy is lost in heating the material of the seats and adjacent woodwork.

On the convention program were set down a number of subjects for discussion by the delegates. One of these, "The So-Called Superiority of Exhaust-Steam Over Live-Steam Heating," provoked a lively discussion by the advocates of the different systems. Prof. J. D. Hoffman, of Purdue University, pointed out that live steam is obviously hotter than an equivalent amount of exhaust steam from which the heat units have been removed during the expansion through engine cylinders. President Bolton said that the claim of the exhaust-steam advocates has sometimes been that the presence of moisture in this steam aids in the transmission of heat from the steam to the radiator surface. Mr. Gifford substantiated this point, declaring that saturated steam has a higher heating value in practical use than live steam, and he also said that an engine or other prime mover is the most efficient and economical kind of a reducing valve.

Among the entertainment features of the convention were a reception on the Hotel LaSalle roof garden, a 25-mile automobile ride through the parks and boulevards of Chicago, a moonlight boat ride on Lake Michigan, inspection trips through the mechanical plants of the Blackstone, Congress and LaSalle hotels, besides several special entertainment features for the visiting ladies.

Modification in New York System of Accounts.

An order was passed by the New York Public Service Commission, First District, on June 23, modifying the uniform system of accounts for electrical corporations. Effective on Jan. 1, 1912, two additional primary accounts are to be provided in the classification of operating expenses. They will be entitled "joint transmission expense—dr." and "joint distribution expense—dr."

The text of "joint transmission expense" provides that when any transmission wires or cables or any poles or conduits carrying the same are maintained by another person or company for the joint benefit of the accounting corporation and others under an arrangement for apportioning the expense of maintenance and operation the portion of such expense to be met by the accounting corporation shall be charged to this account. The portion so charged may include provision for depreciation of such structure or facilities as well as current outlay for repair, but must not include any allowance for profit or return upon such property. The allowance for profit should be charged to the sub-account "joint facility rents" under "other rent deduc-

tions." Where no arrangement exists for division of the expense of maintaining a joint facility the entire payment is chargeable to the sub-account "transmission subway rent" or the sub-account "miscellaneous rent deductions" under "other rent deductions."

When any distribution structure or facilities are maintained by another person or company for the joint benefit of the accounting corporation and others under an arrangement for apportioning the expense of maintenance and operation the portion of such expense to be met by the accounting corporation shall be charged to the account "joint distribution expense." The portion so charged may include provision for depreciation of such structure or facilities as well as current outlay for repair, but must not include any allowance for profit or return upon such property. The allowance for profit should be charged to the sub-account "joint facility rents" under "other rent reductions." Where no arrangement exists for the sharing of the expense of maintaining a joint facility the entire payment is chargeable to the sub-account "distribution subway rent" or the sub-account "miscellaneous rent deductions" under "other rent deductions," according to the kind of facility.

Gas-Rate Controversy in Chicago.

Rates of 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years have been recommended by the City Council committee on gas, oil and electric light as the price for gas in Chicago. The Council has not yet adopted the committee's report, however, and if it does the People's Gas Light & Coke Company may fight the reduction in the courts. The present rate is 85 cents. Under the preceding administration, when the committee was differently constituted, it employed Mr. W. J. Hagenah as an expert to investigate the company's business and recommend a reasonable rate. Mr. Hagenah reported in favor of 77-cent gas, but his report was not satisfactory to the new committee, which employed Mr. Edward W. Bemis as a second expert. Mr. Bemis recommended a sliding scale of 75 cents for one year, 70 cents for three years and 65 cents for one year. The committee changed these figures somewhat, arriving at the decision mentioned previously. Mr. Bemis considered Mr. Hagenah's figures too high in many respects. After refusing to divulge records and working data on which his report was based, Mr. Hagenah resigned from the service of the committee on July 7. He said that the information was obtained from the gas company in confidence and he would not break his promise.

Rate Question in Toledo and Cleveland.

City Solicitor Schreiber, of Toledo, Ohio, has filed suit against the Toledo Railways & Light Company to force it to accept a franchise that was enacted by the City Council in May of this year. This franchise fixes the rate for energy at 8 cents per kw-hour, with a discount for payment of bills within a stipulated time. The minimum charge is fixed at 50 cents per month. The company had informed the City Council that it could not accept this ordinance, and proposed another plan by which the consumers would be charged according to the amount of energy used. In cases where an ordinary amount was consumed the charges would be even lower than those fixed by the ordinance, and where used in large amounts it would be furnished at such a price as to be attractive. The suit filed asks for an injunction to prevent the company from disconnecting consumers who fail to pay their bills according to the company's figures.

The petition states that the company has been operating under grants made to the General Chandelier Company, Citizens' Electric Lighting Company, Toledo Brush Electric Light & Power Company, Toledo Consolidated Electric Company, Toledo Electric Street Railroad Company and the Western Electric Light & Power Company.

An attempt is being made to reduce the prices charged by the Cleveland Electric Illuminating Company, Cleveland, Ohio, for service. These rates now range from 12½ cents per kw-hour to 5 cents, according to the number of lamps used and the amount of energy consumed. Councilman Haserodt has prepared an ordinance that will carry into effect the plans formulated by the late Mayor Tom Johnson, which would reduce the rates perhaps one-third, making the maximum 8 cents instead of 12½ cents. The basis of the proposed ordinance is the provision in the company's contract with the city that the rates may be readjusted by the City Council at the end of each ten-year period. This provision has not been taken advantage of for some time.

Rate Discussion at Los Angeles.

By LeRoy W. Allison.

Through an ordinance drafted by the City Council under recommendations of the Board of Public Utilities and a favorable vote of the people (see *Electrical World,* July 19, 1910), Los Angeles, Cal., has been accorded a 7-cent lighting rate, with $1 minimum, during the past year. In the fixing of charges for the ensuing year, July, 1911-12, the city has again engaged in a controversy.

On May 15 the Board of Public Utilities, a body of three, who, like the members of other commissions, serve without remuneration and solely for the honor attending the position, with the assistance of its regularly employed engineer, Mr. T. B. Comstock, and three consulting engineers, Prof. W. F. Durand, Leland Stanford University; Mr. E. F. Scattergood, chief electrical engineer of the city power bureau, and Dr. George L. Hoxie, New York, adopted a new schedule of rates to become effective July 1. These were based on a valuation of the existing plants of the power companies, allowing a 6 per cent depreciation on physical property, excluding real estate and permitting a percentage of return to capital invested of approximately 7 per cent.

The appraisal made of two of the three plants serving the city by the board of engineers conceded to the Southern California Edison Company a value of $6,466,241, including a contract with the Los Angeles-Pacific Railway. One million dollars of this sum represented, in the words of the board, "possible legitimate expenses for development which may not have been covered by past earnings." The Los Angeles Gas & Electric Company was credited with $2,570,415. Lack of sufficient time necessitated the omission of an inventory of the Pacific Light & Power Company. The annual statement filed by this corporation at the commencement of the year gives gross earnings of $1,333,900, and property valuation, neglecting franchise, of $6,474,061.

LIGHTING RATES.

The approximate annual output for lighting in the city is for the Southern California Edison Company, 13,687,383 kw-hours; Los Angeles Gas & Electric Company, 15,040,486 kw-hours; Pacific Light & Power Company, 11,022,565 kw-hours. The metered connections are between 57,000 and 60,000.

By considering the various classes of consumers and distributing cost for supplying service the board fixed what it believed just and equitable rates to company and consumers. A curve, shown in Fig. 1, was laid down for comparison of the rates in force and those proposed for a consumption under 300 kw-hours per month. In accordance with their conclusions a sliding scale of charges per month was established as follows:

First 250 kw-hours, 6½ cents; between 250 kw-hours and

500 kw-hours, 6 cents; between 500 kw-hours and 1000 kw-hours, 5 cents; between 1000 kw-hours and 2000 kw-hours, 4 cents; between 2000 kw-hours and 4000 kw-hours, 3 cents; in excess of 4000 kw-hours, 2¾ cents. The $1 minimum was abolished and in its stead a standing charge of

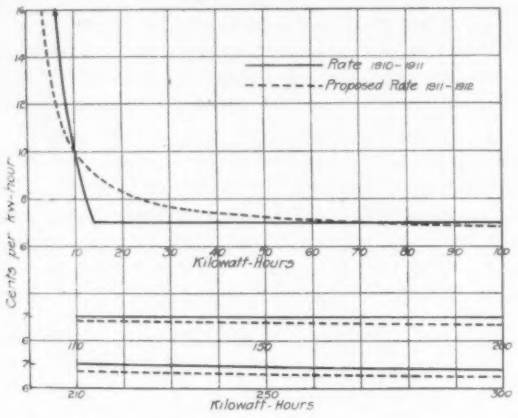


Fig. 1—Comparison of Unit Rates for Consumption Less than 30 Kw-hours per Month.

35 cents, termed a "connection charge," was established, this being based upon the cost to the company of rendering service, such as meter connection, reading meters, testing and repairs, collecting and clerical work.

The curve shown in Fig. 2 gives the cost to the small consumer under the present and suggested rate. It shows, as does Fig. 1, that when using under 10 kw-hours the user is benefited; the increase applies to those who consume

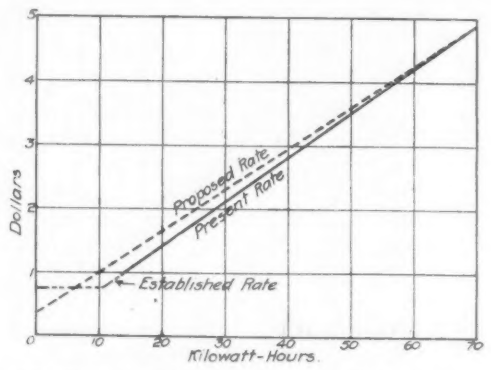


Fig. 2—Aggregate Charge up to 70 Kw-hours.

between 10 kw-hours and 70 kw-hours, who are variously estimated to represent from 70 per cent to 90 per cent of the consumers. Beyond 70 kw-hours the charge again becomes lower.

ENERGY RATES FOR MOTORS.

This is the first year that the city has extended its regulation to energy rates for motors. The schedule as provided by the board reduced the base from 9 cents to 7 cents per kw-hour, the new rates being as follows:

First 100 kw-hours, 7 cents; between 100 kw-hours and 500 kw-hours, 6 cents; between 500 kw-hours and 1000 kw-hours, 5 cents; between 1000 kw-hours and 1500 kw-hours, 4 cents; between 1500 kw-hours and 2000 kw-hours, 3 cents; in excess of 2000 kw-hours, 2 cents. There is a minimum charge of 50 cents per month per horse-power installed.

A special schedule arranged on the block system is based on a maximum demand, or fixed charge, plus an energy-consumption charge. The fixed charges are $1.50 a month per horse-power for demand from 1 hp to 10 hp; $1 a month per horse-power for demand from 11 hp to 20 hp, and 50 cents a month per horse-power for demands in excess of 20 hp. Thus a consumer having a maximum demand of 30 hp would be asked to pay a fixed charge of $15 for the first 10 hp, plus $10 for the next 10 hp and $5 for the next 10 hp, or a total of $30. To this would be added the cost of electrical energy at the following rates: For the first 3000 kw-hours, 2 cents; 100,000 kw-hours, 1 cent, and all above, 0.9 cent. Where the consumer is given the option of direct current and alternating current and elects the former the rates given in the special schedule increase 15 per cent.

PUBLIC DISCUSSION.

Declaring that the proposed rates discriminated against the small resident consumer, many citizens and protective organizations filed protests with the Mayor. Industrial companies also entered complaint that their present bills would be increased under the new schedule, and, as provided by the city law, the matter was placed before the City Council.

Argument between the City Council, citizens and the Board of Public Utilities reaching no ultimate conclusion, a special committee composed from the membership of the Council was appointed to confer with Engineers Scattergood and Comstock and instructed to arrive at an amicable decision. Almost coincident with this ruling the Board of Public Utilities tendered resignations to the Mayor June 30, which were accepted.

On July 1 the special committee introduced an ordinance providing a schedule of rates practically identical with that now in force and reducing the $1 minimum to 75 cents. This is shown in the diagram, Fig. 2. The effective charges become as follows:

Lighting Rates.—No meter charge. Minimum charge, 75 cents per month. First 250 kw-hours, 7 cents. Continuing the same as suggested by the board up to above 4000 kw-hours.

Energy Rates for Motors.—First 100 kw-hours, 7 cents; between 100 kw-hours and 300 kw-hours, 6 cents; between 300 kw-hours and 500 kw-hours, 5 cents; between 500 kw-hours and 1000 kw-hours, 4 cents; between 1000 kw-hours and 1500 kw-hours, 3 cents; between 1500 kw-hours and 2000 kw-hours, 2½ cents; between 2000 kw-hours and 3000 kw-hours, 2 cents; between 3000 kw-hours and 4000 kw-hours, 1½ cents; in excess of 4000 kw-hours 1.4 cents.

The ordinance was formally considered a week later and again on July 11.

New York Commission News.

The Public Service Commission, Second District, has authorized the Central Hudson Gas & Electric Company to issue $1,400,000 of 5 per cent thirty-year bonds, for the purpose of paying off and canceling bonds of the Poughkeepsie Light, Heat & Power Company to the amount of $600,000; of the Newburgh Light, Heat & Power Company to the amount of $700,000, and of the Hudson Counties Gas & Electric Company to the amount of $100,000, these companies having been consolidated with the permission of the commission. The company is also authorized to issue $600,000 bonds, to be sold at not less than 95¼, for the discharge of obligations of the consolidated company incurred for proper capital purposes.

This week the commission will have further hearings on the complaints of various municipalities in Westchester County against the Westchester Lighting Company as to prices of gas and electricity.

The Public Service Commission, Second District, has authorized the Northern Westchester Lighting Company to exercise franchises granted for the furnishing of gas and electricity to the villages of Pleasantville and Briarcliff Manor and in the town of Mount Pleasant.

The commission has approved of the sale, transfer and assignment to the New York Telephone Company of a certain franchise granted by the board of trustees of the village of Cobleskill and held by the Cobleskill Telephone Company. The petition states that the best interests of

the telephone-using public in the villages of Cobleskill, Lawyersville, Sharon and the surrounding territory will be served by the direct ownership and operation of the property by the New York Telephone Company. The company also proposes to merge the Cobleskill & Sharon Telephone Company.

Maryland Commission News.

The Maryland Public Service Commission received last week from the Consolidated Gas, Electric Light & Power Company replies to complaints made as to the prices of gas and electricity by Mayor Preston and City Solicitor Poe. The company stated that it is ready to facilitate the inquiry and have the commission pass upon the reasonableness of the rates. The property and plants of the company and its records and books are open to investigation by the commission. The answer also indicates that future reductions in rates are probable, the policy of the company, as stated, being to reduce voluntarily the price of its commodities when the growth of its business and the cost of operation make reductions possible. The reply to the complaint about the cost of electricity was filed by Mr. Herbert A. Wagner, vice-president in charge of the electric division. Both answers hold that the present prices charged for gas and electricity are not unjust or unreasonable.

Preparatory to the inquiry into the rates of the Consolidated company, the commission has approved an outline prepared by its chief engineer, Charles E. Phelps, covering items of information to be included in the investigation. These items are grouped under six different schedules and cover the following subjects: Schedule 1—Book values of the elements that make up the total valuation of the plant and property operated by the electric division of the company for municipal street lighting; 2—Operating income and expenses of the electric division; 3—Data in respect to the production and distribution of electricity; 4—Book values giving the valuation of the separate items in the gas division of the company; 5—Operating income and expenses of the gas division; 6—Data in respect to the manufacture and distribution of gas. In adopting the recommendations of the chief engineer, the commission also decided that the inquiry should cover the entire gas and electric systems without any attempt to separate the values in the city of Baltimore from those in the adjacent territory, and should comprise complete inventories of the plants and properties of the gas and electric divisions separately. The commission's auditor, Colonel John A. Tompkins, will not be placed at work on the company's books until after the first public hearing, to be held July 19, which hearing will be in the nature of a preliminary one, at which the commission will be glad to hear from the general public. The real work, involving the preparation of these inventories and valuations, is expected to consume some months.

Wisconsin Commission News.

The Wisconsin Railway Commission, after an investigation into the affairs of the Madison Gas & Electric Company, has handed down a decision reducing the company's rates for electric lighting about 14 per cent. This will involve a decrease in revenues to the extent of approximately $25,000 annually. This is the second reduction made in the company's rates in the last year and a half. A decision and order of the commission in the case of the State Journal Printing Company et al. vs. the Madison Gas & Electric Company, dated March 6, 1910, made effective certain reductions and readjustments of the then existing schedule of rates. These changes involved the substitution of a rate based upon the connected load as well as the amount of energy used in place of a schedule based entirely upon the energy consumed with a discriminatory discount for quantity. The original maximum rate was 16 cents per kw-hour. In the decision, dated March 8, 1910, a schedule, involving a primary net rate of 14 cents, with a secondary rate of 8.5 cents and an excess rate of 5 cents, was ordered. The reduced schedule recently ordered is as follows: Primary net rate of 12 cents per kw-hour for the first thirty hours' use per month of the active connected load: secondary net rate of 8 cents per kw-hour for the next sixty hours' use per month of the active connected load; excess net rate of 4 cents per kw-hour for all additional energy consumed. The minimum bill is to be $1 per month.

The above schedule applies to Classes A, B and C. In Class A are included residences, flats and private rooming houses. Where the total connected load is equal to or less than 500 watts nominal rental capacity, 60 per cent of such total connected load is to be considered active; where the installation exceeds 500 watts, 33 1/3 per cent of such part of the total connected load over and above 500 watts is to be considered active. Class B consists of banks, offices, wholesale and retail merchandise establishments, saloons, public halls, restaurants, depots, etc. Where the total connected load is equal to or less than 2.5 kw nominal capacity, 70 per cent of the total connected load is to be considered active; where the installation exceeds 2.5 kw, 55 per cent of such part of the connected load over and above 2.5 kw is to be deemed active; lamps used exclusively in space devoted to the storing of goods are to be placed at 20 per cent active and are not to be included in the 2.5 kw specified above. In the original order all Class B installations were rated at 70 per cent active, but as an inducement to larger installations the commission reduced the percentages to the figures given above. Class C consists of federal, state and county buildings, churches, hotels, clubs, factories, private schools, warehouses, liveries, etc. In this class 55 per cent of the total connected load is to be deemed active. For all energy furnished the University of Wisconsin a maximum charge of 5.5 cents net per active lamp of 50 watts equivalent per month is to be made, plus 4 cents per kw-hour for energy consumed. Thirty per cent of the total connected load is to be considered active. For all signs and window lighting, on a yearly contract basis, a charge of 4.5 cents net per active 50 watts equivalent per month, plus 4 cents net for energy, is to be made. In this class the total connected load is active.

The reasons given for the second reduction are the economies effected by the company during the past year and the enormous increase in sales brought about by the inducements offered to use additional energy under the commission's form of rate. The company has operated under this rate for a little over a year, and an accurate comparison was, therefore, possible between conditions before and after the commission's form of rate was put into effect. The analysis of the electrical department costs disclosed rather interesting results. A comparison of the year ended March 31, 1911—the year in which the commission's first order was effective—with the year ended Dec. 31, 1909, showed that the cost per kw-hour for arc service had decreased from 5.69 cents per kw-hour to 5.6 cents; for incandescent lighting, from 9.78 cents to 9.31 cents; for motor service, from 5.63 cents to 5.55 cents. The consumer, demand and output costs for incandescent service, when compared with those for the year ended June 30, 1909, show a somewhat reduced cost. Consumer costs have decreased from $9.042 per consumer per annum to $7.566. Demand costs have been reduced from 5.55 cents per active lamp to 5.108 cents. Output costs have decreased from 4.52 cents per kw-hour to 4.181 cents. A comparison of unit costs showed a range in cost per kw-hour in the year ended March 31, 1911, varying from 11.39 cents where energy is used but one hour per day to 4.48 cents where energy is used for twenty-four hours, compared with a range of from 12.65 cents to 4.86 cents for the year ended June 30, 1909. The comparison showed further that the total

gross earnings have decreased from 6.5 cents to 6.3 cents per kw-hour sold; that the operating expenses have decreased from 3.44 cents to 3.05 cents per kw-hour sold. The decrease in the operating expenses was due to a decrease in the distribution, collection and general expenses, brought about by a more economical management. The net earnings of the company show an increase from 3.06 cents to 3.25 cents per kw-hour sold.

The effect of the commission's form of rate was most noticeable in the residence-lighting business. The investigation showed that while the residence consumers have increased 34 per cent, the number of lamps connected for this class of service has increased 53 per cent and the kw-hours sold 70 per cent. The large increase of demand and use of energy for the class has increased the revenues even under the reduced rate 35 per cent for the class. The net revenues from incandescent lighting increased from $59,017 in 1907 to $80,527 during the year ended March 31, 1911. Statistics show that a large portion of the increase in energy sold during the latter period was paid for at the secondary rate. That is, the increase was due very largely to a longer daily use of the active connected load as well as to the increase in the number of electrical appliances other than lamps, the use of which was encouraged by the low secondary rate. Stores had actually decreased their number of lamps connected, but have increased the amount of energy used 25 per cent. The accruing revenues increased 10.9 per cent.

The company's gas business did not show much of a change either in operating expenses or in revenues. It was deemed inadvisable to change the existing gas rates until certain contemplated additions to the plant are placed on a revenue-producing basis.

CURRENT NEWS AND NOTES.

A. I. E. E. Secretaryship.—A committee as follows has been named by President Jackson to canvass the candidates for the office of secretary of the American Institute of Electrical Engineers and report its recommendations to the board of directors: President-elect Gano Dunn, chairman; Vice-president Harold W. Buck and Manager W. S. Rugg. Among members who are mentioned in connection with the secretaryship are Messrs. Horatio A. Foster, F. L. Hutchinson, W. J. Jenks, H. H. Norris, George F. Sever, Samuel Sheldon and Percy H. Thomas.

* * *

Automobile Engineers' Handbook.—The Society of Automobile Engineers is preparing for publication a handbook for automobile engineers, in which will be printed standard specifications for material and information as to the treatment of material and the methods of testing it, with further information pointing the way to many short cuts, etc., in calculations and testing.

* * *

Proceedings of Congress of Technology.—The *Proceedings* of the Congress of Technology, held in Boston April 10-11, will be published in a volume of about 500 pages, which will be sold at a moderate price. The contents include the seventy-odd technical papers, relating to many fields of industry, which were read at the celebration of the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology.

* * *

Payment to City Where Franchise Has Expired.—The Wayne County Circuit Court of Detroit has upheld the contention of the corporation counsel that the Detroit United Railway Company must pay the city $200 a day for the use of the streets occupied by its railway tracks and on which the Fort Street line franchise has expired. The company is allowed until July 18 to decide whether it will pay the rental. If it refuses to do so, the city is adjudged to have the right to stop the operation of the Fort Street line and to compel the removal of the company's equipment on the streets affected.

* * *

Ohio Isolated Plants Selling Energy to Be Taxed.—The Ohio State Tax Commission has decided to require all private companies selling electrical energy to consumers to list their properties for taxation on the same basis as gas and electric companies are required to do. Acting upon this idea, blanks have been sent to the Commercial Tribune Building Company and the Butler Building Company, of Cincinnati, with instructions that their entire properties be listed on this basis. It is said that there are twenty-five such private plants in Cincinnati. The commission exempts companies which furnish energy to tenants as part of their rent.

* * *

Toronto Rates for Electric Service.—A new schedule of prices for electric energy, which the Toronto (Ont.) Electric Light Company announced some time ago would shortly be issued to meet the competitive rates of the civic hydroelectric system, was made public on July 6. The commercial lighting rate is 8 cents per kw-hour for thirty hours' use per month, and 3 cents per kw-hour for all excess, with 10 per cent discount on one-year contracts. For alternating-current motors the rate is 5 cents per kw-hour for the first fifty hours' use of maximum demand per month; 1 cent for the second fifty hours' use and ½ cent for all excess, with 10 per cent discount on yearly contracts.

* * *

Canadian Canal Water-Power.—The government of the Province of Ontario has challenged the right of the Dominion government to control and dispose of the water-powers developed by the canals. The contention of the Whitney (provincial) government is that the water belongs to the province before it enters the canal and after it leaves the canal, and that, except for purposes of navigation, the water belongs to the province when it is in the canal. The provincial government claims that the Dominion's only right under the Act of Confederation is to use the water in the canals for purposes of navigation, and the federal authorities have been informed that the provincial government intends to assert its rights to control all water-power grants in the canal and to demand a repayment of the $100,000 per annum revenue which the Dominion government now derives from such grants.

* * *

Government Inspection of "Wireless" on Shipboard.—Three inspectors of wireless telegraph apparatus on vessels—Messrs. Richard Y. Cadmus, William D. Terrell and Charles St. J. Howard—have been appointed by the Department of Commerce and Labor of the United States government. The law requiring all passenger vessels plying from United States ports to have "wireless" equipment sufficient to call for help in cases of emergency is now in force and all vessels will be inspected to see that they comply with the law as soon as the newly appointed inspectors can enter upon their duties. It will be the duty of the inspectors to go aboard all outgoing vessels carrying more than fifty passengers to inspect not only the apparatus itself, but to pass judgment upon the qualifications of operators. No vessel will be permitted to leave a United States port without a certificate of inspection. If an inspector is not at hand the master of the vessel is required to deposit a certificate with the customs officials. Vessels violating the "wireless" laws will not be refused clearance, but will be fined. Wireless operators holding certificates by the governments which ratified the Berlin wireless-telegraph conference will be acceptable to the United States authorities. To secure a certificate from the United States government it will be necessary for operators to pass an examination.

ISOLATED PLANTS IN CHICAGO.—Figures given in the recent annual report of the department of electricity of the city of Chicago show that there are 763 isolated electric plants in that city supplying 19,670 arc lamps and 788,034 incandescent lamps.

* * *

ELECTRIC LIGHTING IN THE SOCIETY ISLANDS.—An electric-lighting system has just been installed in Papute, the chief city of the Society Islands, in the Pacific Ocean, and according to consular reports the new lamps are productive of the greatest curiosity among the natives, who come in from miles around to see them. Fifty kw of generating capacity is installed in the new plant, which is owned by a progressive American resident.

* * *

ANNUAL REPORT OF DEPARTMENT OF ELECTRICITY OF CHICAGO.—The annual report of Mr. William Carroll, city electrician, for the year 1910, recently issued, shows that the department of electricity of the city of Chicago expended $1,239,782 last year and earned $194,589. The expenses were principally for electric, gas and gasoline street lighting, while the revenue was mainly derived from electric inspections. On Dec. 31, 1910, there were 408 officers and employees in the department.

* * *

STREET LAMPS OF ALL KINDS IN CHICAGO.—Figures given in the recent annual report of the department of electricity of Chicago show that the total number of public street lamps in service on Dec. 31, 1910, was 37,994. Of these, 12,366 were municipal electric-arc lamps, 893 rented arc lamps, 11,990 gas-mantle lamps, 5426 gas flat-flame lamps and 7319 gasoline lamps. The cost of rented arc lamps is $75 a year, municipal arc lamps $61.95 a year, mantle gas lamps $18.91, open-flame gas lamps $15.41, and gasoline lamps $26.40.

* * *

WIRELESS TELEGRAPHY IN INDIA.—The military authorities of the government of India have a plan of wireless telegraphy to knit together the various units of the army in India. Four stations have been completed and the wireless apparatus is to be installed by the Marconi company. This is the first appearance of the company in India, the system at present in use for commercial and general purposes being the Lodge-Muirhead system. The scheme is exclusively for military use, and it it understood that eventually every military station in India will have its wireless apparatus in charge of trained army officers.

* * *

THAT GARY EXCURSION.—The General Electric Company has issued a card in which it expresses its regret that its guests were disappointed on the occasion of the excursion to Gary on June 29, during the Chicago convention of the Institute, at not being taken through the electrically equipped rolling mills. The Indiana Steel Company explains the omission by saying that the party exceeded the number registered by 200, thus rendering inadequate the provisions made for the safe conduct of the party. The General Electric Company hopes that it may show this interesting electric drive to members of the party at some future time.

* * *

EXPOSITION OF INVENTIONS AT ST. LOUIS.—The International Exposition of Inventions at St. Louis, postponed from last April, will, it is now promised, be held during the week of Sept. 11 in the St. Louis Coliseum. The purpose of the exposition is declared to be the bringing together of investors and inventors, and manufacturers and buyers. Patented machines, appliances, tools, devices and processes of varied character will be exhibited, a department being set aside for electrical inventions. The purpose of the promoters has been to establish an educational institution which shall attract the attention of capitalists and corporation officials, superintendents, etc., who will be interested in the development of the appliances shown. Mr. F. W. Payne is secretary-manager of the exposition.

* * *

ENERGY GENERATED IN LONDON AND IN NEW YORK.—The returns issued by the London County Council relating to the amount of electricity generated in and around London show that in London the borough councils generated or purchased 91,851,181 kw-hours, of which 75,115,968 kw-hours, or 82 per cent, was sold. Information regarding the kw-hours generated by the London companies is not available, but they disposed of 137,211,288 kw-hours. Whether this included that used by the railways is not stated. In New York City the amount of energy generated by the public-utility companies last year is estimated to have been 1,750,000,000 kw-hours.

* * *

INTERLOCKING SYSTEM OF CHICAGO SUBWAYS.—Mr. J. W. Pearl, a former member of the Chicago city engineer's staff, appeared before the committee on local transportation of the Chicago City Council on July 5 to explain his plans for combined routes of "interlocking" subways for the city of Chicago. The scheme outlined by Mr. Pearl contemplates the construction of a number of interleaved loops in the down-town district in which tracks from the North Side share island platforms with West Side tracks, and other West Side tracks share island platforms with South Side tracks, permitting transfers across town to be made easily. As proposed the plan would require 13¾ miles of tunnels, which, the designer estimates, could be built at a cost of $15,000,000.

* * *

RESISTANCE TO ELECTRIC SHOCK.—A list of electrical accidents in the city of Chicago in 1910, given in the annual report of the department of electricity of that city, shows some curious discrepancies. Thus, on Aug. 17 Mr. Harry E. Ames, a lineman, received a shock while working on a ladder on a 40-volt alternating-current circuit which proved fatal, but on Sept. 29 Alice O'Neill, a schoolgirl, was merely burned and shocked by coming in contact with a conductor carrying 7300 volts. This accident is reported as "not serious," although the emf involved is so much greater. Of course, in all cases of electrical accident it is necessary to know all the circumstances to form a correct judgment. The instances cited, however, show that the voltage of a circuit, while an important, is not necessarily a determining factor in cases of accidental electric shock.

* * *

COST DATA OF COMMERCIAL VEHICLES.—At a meeting on June 29 of the Metropolitan (New York City) Section of the Society of Automobile Engineers the desirability of cost data applying to commercial vehicles was dwelt upon. Mr. William P. Kennedy, chairman of the meeting, said there are four main divisions to be considered, the first including such items as interest on investment, depreciation, etc.; the second, upkeep, including cost of tires, battery charging and lubricating oils; the third, garage expense, including garage labor, and, fourth, the chauffeur labor account. Interest and depreciation of buildings, office equipment, garage equipment and other non-working equipment can be easily agreed upon. The logical way to consider depreciation is to separate the working and non-working portions, bearings, tires, etc., being regarded as material used up in work. While ten years is a long time, it is not too long to assume, as shown by electric-vehicle equipments now in use. What the prospective purchaser most wants are reliable data on the cost of operation, and it was added that if some body like the present one does not provide proper cost systems the introduction of the commercial motor vehicle will be retarded.

Moving Pictures Aboard Transcontinental Trains.—As a means of exhibiting the beauties and resources of the Pacific Coast country which it reaches, the Southern Pacific Railroad is planning to put several moving-picture cars in service on its transcontinental trains. Lecturers will accompany the exhibition cars to give information to passengers.

* * *

Russian Hydroelectric Projects.—A Russian government technical commission has approved a project for two large hydroelectric developments, one at Lars, in northern Caucasus, and the other on Lake Gotchkha, in Transcaucasus. The promoter, who is a British subject, is now endeavoring to obtain capital in London to carry out the work.

* * *

Residence Lighting and Rates.—The Public Service Commission of Wisconsin has found that following the adoption in Madison of a schedule of rates favorable to residence lighting the number of residence consumers has increased 34 per cent, while the number of lamps connected has increased 53 per cent and the number of kw-hours sold no less than 70 per cent.

* * *

"Electric Delivery—Economical, Efficient."—The electric delivery wagons of the Commonwealth Edison Company in Chicago serve as a constant reminder of the advantages of electric vehicles wherever they go, as they bear the legend, "Electric Delivery—Economical, Efficient," in neat lettering. These four words seem to present the case of the electric commercial wagon with brevity and force.

* * *

Ohio Telephone Situation.—It is reported that the Bell and Ohio Independent telephone companies are working out a plan for consolidation of service where a town has two telephone systems, and that a proposition will be made to the new Public Utilities Commission whereby subscribers will pay for calls made, not by the month. In connection with this, it is said that a minimum charge will be made in order that companies may not be put to the trouble of installing telephones merely for the convenience of those who may want to make only an occasional call.

* * *

Turbine-Driven Vessel with Electrical Speed Reduction.—Opportunity for comparing the performance of recent improvements in speed-reducing gears with generator-motor systems of connection between steam turbines and propellers will be offered in the construction of two sister-ship colliers now building for the United States Navy. The new collier *Neptune* is to be equipped with Milville-MacAlpine reducing gears, while the turbines of the new coal-carrier *Jupiter* will drive generators which in turn supply energy for operating the motors on the propeller shafts.

* * *

Electric Fan Stolen from the Police.—It is reported from Pittsburgh that while a number of detectives were grouped about the desk of the assistant superintendent of police receiving instructions in relation to recent burglaries someone remarked that the atmosphere was "close," and it was found that an electric fan which had stood on a windowsill had disappeared. The freshly severed ends of the 110-volt circuit operating the fan seemed to indicate that a daring thief had cut the wires while the fan was in motion and had made away with it under the very noses of the detectives.

* * *

Interruption to Chicago Drainage Canal Hydroelectric Service.—During a severe thunderstorm on the evening of June 26 the transmission line of the Sanitary District, running from the Chicago Drainage Canal hydroelectric plant at Lockport, Ill., to Chicago, was put out of commission, being presumably disabled by lightning. All the energy for Chicago's 12,000 street arc lamps is received over this line, so that for several hours no electric street lamps were in service. Furthermore, all other customers of the Sanitary District were similarly affected, including a large amusement park.

* * *

Rates at Huntington Park, Cal.—The City Council of Huntington Park, Cal., has taken official action fixing the rate for electric service at 8 cents a kw-hour, instead of the previous rate of 12 cents, with a minimum charge of $1 a month. For some time there has been an agitation of this subject, and it is reported that the Pacific Light & Power Corporation has refrained from making extensions of its service in Huntington Park pending the outcome. The company is reported to have offered to make the new connections provided the City Council would agree to a rate not lower than 10 cents, but the city fathers refused to accept this compromise and there may be a contest in the courts. An election to vote on the question of municipal ownership of water-works and electric-service plant is in prospect also.

* * *

Royal Show at Norwich, England.—Judging by the exhibits at the Royal Agricultural Society's Show at Norwich, England, the use of electrical apparatus for agricultural purposes is still very limited in the United Kingdom. Ten generators were shown, most of which were coupled to gas or oil engines. Some motors used in connection with various small machines for farm work were to be seen, and also two complete electric-lighting equipments consisting of low-speed petroleum engines, generators, controllers, switchboard, etc., for forty lamps and 125 lamps respectively. These plants were automatic, the engine being started by turning one of the lamp switches and shut off when the lamps were switched off. For this purpose only small batteries were needed similar to those used for ignition purposes.

* * *

Production of Mica.—The total value of the mica produced in the United States in 1910, according to an advance chapter from "Mineral Resources of the United States, 1910," by Mr. Douglas B. Sterrett, just issued by the United States Geological Survey, amounted to $337,097, exceeding by $56,568 the value of the production of 1909, and was greater than in any other year except 1907, when it amounted to $392,111. The production of sheet mica amounted to 2,476,190 lb., valued at $283,832, an increase of 666,608 lb. in quantity and of $49,350 in value, as compared with the output of 1909. The production of scrap mica amounted to 4065 tons, valued at $53,265, a decrease of 25 tons in quantity and an increase of $7,218 in value, as compared with 1909. The production came from seven States—North Carolina, South Carolina, South Dakota, New Hampshire, Colorado, New Mexico and Massachusetts—named in the order of the value of their output. Sheet mica is used for gas-lamp chimneys, for lamp shades and for glazing and is punched into disks and washers or cut by shears—either hand or power—into patterns for use in stoves and electrical apparatus. The electrical industry consumes by far the greatest part of the sheet mica produced. A large quantity of mica too small to be cut into sheets and also the waste from the manufacture of sheet mica is ground and used in the manufacture of wall papers, lubricants, fancy paints, molded mica for electrical insulation, etc. Ground mica applied to wall papers gives them a silvery luster. Coarsely ground or "bran" mica is used to coat the surface of composition roofing material to prevent the tar or other composition used in its manufacture from sticking when the material is rolled for shipping.

ERIE COUNTY ELECTRIC SYSTEM.

Modern Steam-Turbine Generating Station Erected Near Presque Isle Bay at Erie, Pa.

ERIE, Pa., has a population of 66,525. It has two electric-light companies, two telephone companies, two telegraph companies, two gas companies, three railway companies and five railroads, so that so far as competition is concerned it is not lacking. The Erie County Electric Company is the larger of the two electric-light companies, the other company, the Erie Company, operating a small combination light and steam-heating plant. The former company has just placed in operation a new steam turbine station located at Fifth and Cranberry Streets, near Presque Isle Bay, and adjoining the Erie and Pittsburgh branch of the Pennsylvania Railroad Company. Close by is Cascade Creek, whence condensing water of good quality is obtained. There is in addition a 24-in. cast-iron pipe line from the station to a pumphouse on Presque Isle Bay, where there are installed two centrifugal pumps driven by two 175-hp synchronous three-phase, 2300-volt, 60-cycle motors built by the Burke Electric Company, Erie, Pa.

The design of the station is such that additions can be made to it readily, one end being closed in by a temporary wall of corrugated sheet iron. The construction throughout is fireproof, with a high turbine-room floor, so as to bring the barometric condenser heads close to the turbines. The boiler-room basement, where the hot well is located, is 28 ft. below the turbine-room floor. The steam-generating equipment comprises four Babcock & Wilcox water-tube boilers, each of which is rated at 512 hp and is fitted with a chain grate stoker built by the boiler makers. The furnaces are fed with bituminous slack coal costing from $1.15 to $1.30 at the hoppers. After being dumped from the cars tripper operated by a winch and hand wheel placed at one end of the upper run. The coal is fed to the stokers through chutes.

The ashes, which are also handled by the conveyor, are dumped from a car in the basement into the lower run of the conveyor, loading plates extending along the lower run for a distance of 62 ft. The ashes are carried around the system in the same way as the coal and are dumped into the

Fig. 2—View of Pumphouse and Intake.

ash chute by means of the traveling tripper. The ash chute is placed adjacent to the coal bins and discharges through the wall to cars on the track below. The conveyor is 117 ft. between vertical centers and when operating at a speed of 50 ft. a minute handles 50 tons of coal an hour. The driving mechanism in the basement comprises a head shaft, two countershafts and a 10-hp motor all gear-connected and supported on a self-contained steel frame. The conveyor line is fitted with an automatic gear lock to prevent the conveyor from running backward should the motor stop for any reason when the conveyor is loaded. At present the ashes are used for filling in the low spots around the station.

The reinforced-concrete bunkers are built V-shape and

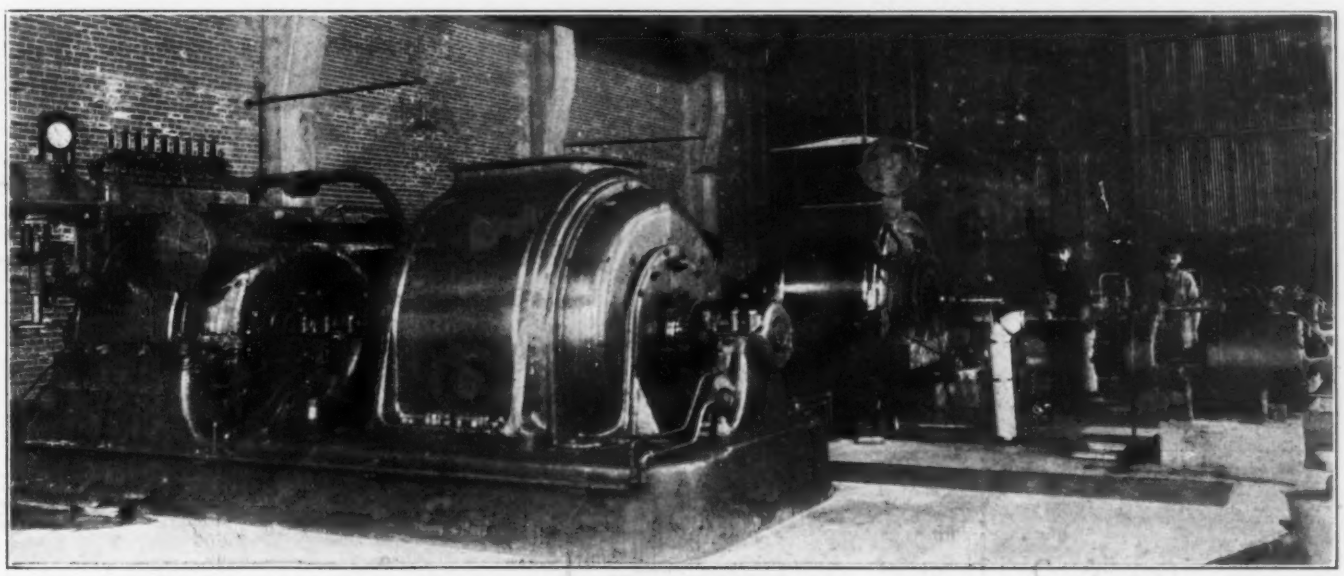


Fig. 1—View of Generating Room.

it is taken on an overlapping pivoted bucket conveyor designed and installed by the Jeffrey Manufacturing Company, Columbus, Ohio. The track hopper is of steel construction approximately 10 ft. by 10 ft. It is equipped with an automatic feeding device which regulates the flow of coal to each bucket as it passes under the hopper. The loaded buckets are carried horizontally, approximately 31 ft., to a point just outside of the building, whence they are taken vertically to the top of the bins. The coal is then distributed over the storage bins by means of a traveling hold some 320 tons of coal. Moreover, the railroad siding provided outside the station has accommodations for 27 cars, so that when the bunkers are filled and the siding holds its full quota of cars approximately 3000 tons of coal are on hand, which is sufficient to tide the station over any reasonable period of shortage due to strikes or delayed shipments. A feature of the boiler-room is the setting of the boilers. Each is set singly with 20 ft. of clear space in front and in the rear, and with 6 ft. of space between units. This makes it possible to remove flues readily from either

the front or the rear of the boiler and renders inspection of the boiler and setting easy. The concrete foundations for the boilers and turbines extend down to solid rock.

Feed water is delivered to the boilers by two compound Heisler pumps, built by the Heisler Engineering Company, St. Mary's, Ohio, all of the auxiliaries exhausting through a

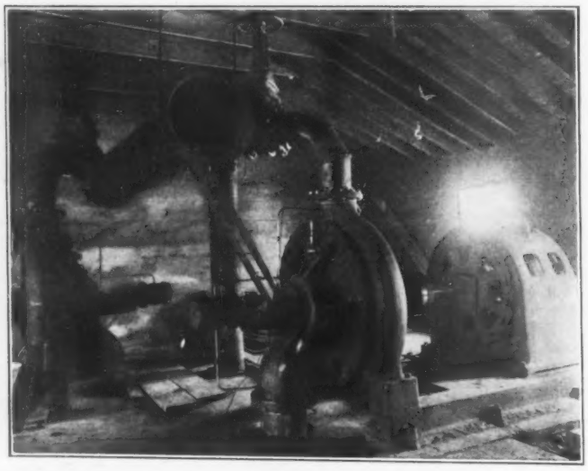


Fig. 3—Interior of Pumphouse.

Cochrane open-type heater built by the Harrison Safety Boiler Works, Philadelphia, Pa. Natural draft is relied on for the boiler furnaces, the products of combustion passing out of a 254-ft. radial brick stack with an inside diameter of 8 ft. erected by the M. W. Kellogg Company, New York City. The latter company also designed and erected all the steam piping in the station.

The turbine equipment consists of two 2500-kw, three-phase, 2300-volt, 60-cycle, four-stage, horizontal General Electric units, taking superheated steam at a pressure of 175 lb. and provided with forced ventilation. Three 35-kw turbine-driven exciters are provided. The condensers,

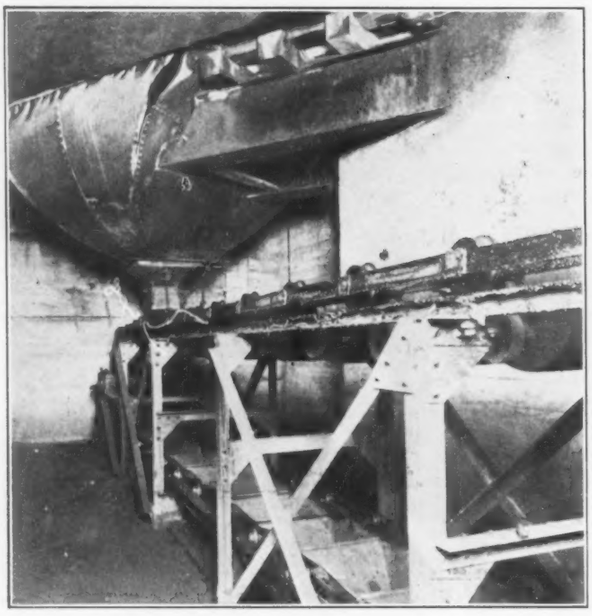


Fig. 4—Track Hopper and Coal Conveyor.

which are of the Alberger barometric type, are supplied with water from the creek flowing by the station or from Presque Isle Bay. The water from the latter source is lifted 60 ft. to the top of the hill overlooking the bay, whence it flows by gravity to the condensers. The pumphouse on the shore is about 1600 ft. from the station, and is 40 ft. x 24 ft. in area. A pit 12 ft. deep by 24 ft. long and 12 ft. wide is connected through a 30-in. pipe line to the intake in the bay, some 157 ft. from shore. The intake is made up of crib work below water and concrete above. Water enters on all sides. Screens are provided in the well in the pumphouse to keep out refuse and fish, principally the latter.

The switchboard is of the standard General Electric type and contains two generator panels, one tie panel, two exciter panels, one synchronizing panel, one Tirrill regulator panel and four feeder panels. The arrangement is such that panels can be added at either end should the station equipment be increased. The oil switches are located on the floor below, immediately beneath the switchboard, so that the highest potential at the board itself is 125 volts. Spanning the turbine-room is a 25-ton Cleveland crane. Of the four sets of feeders provided, one set acts as a tie line between the old and the new station, and the other three sets run to the old station also, the feeders being tied together between two sets of busbars. The lines pass underground from the station to a terminal pole about 100 ft. east of the building, whence they run overhead to the center of the city.

The old station of the company is located at Twelfth and French Streets, in the business section of the city. It contains eight water-tube boilers with an aggregate rating of 2500 hp and fitted with chain-grate stokers. The generating equipment comprises one Filer & Stowell engine driving a 550-kw, 275-volt direct-current machine; one Brown engine driving a 500-kw direct-current machine; one Erie City engine connected to a 450-kw direct-current generator; one vertical engine driving one 450-kw, 275-volt direct-current generator; one Ball engine driving a 450-kw, three-phase, 2200-volt, 60-cycle alternator; one 250-kw motor-generator set with a 2200-volt, three-phase synchronous motor and a 275-volt direct-current generator; one 550-kw motor-generator set similar to the above and eight Brush arc machines designed for 125 lamps; a 250-hp direct-current motor driving a pair of machines. It is proposed to transfer these machines to the new station and drive them with syn-

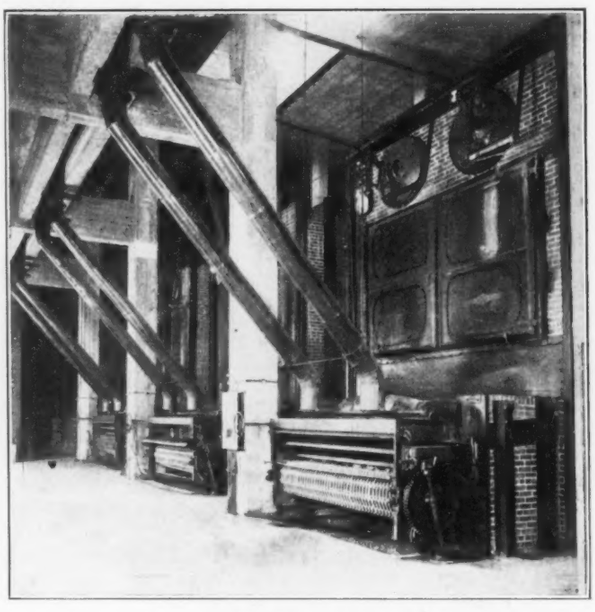


Fig. 5—Boiler-Room in New Station.

chronous motors. The boiler plant will be used for district steam heating.

The distribution is all overhead on 35-ft. poles, with 8-in. tops. The company owns and maintains its own poles and has no wires on foreign poles. The arc lamps are suspended from a stranded cable at the center of the intersec-

tion of the streets. The direct-current three-wire system of distribution with 230 volts between outside wires is employed in the center of the city, and a 500-volt direct-current system for motors reaches the outlying sections. This system will eventually give place to a three-phase system. On the outskirts of the city lamp circuits are supplied with 115-volt single-phase energy and motor circuits with 230-volt or 2300-volt three-phase energy. The motor load on the system has increased to such an extent that the new station is now fairly well loaded.

The company has over 2700 meters out on all classes of service. Natural gas is a strong competitor of electricity in Erie and it sells at 30 cents per 1000 cu. ft. Every house in the city is piped for natural gas, which is used for cooking and lighting. Nevertheless, none of the public buildings except a single hotel has an isolated plant. The company no longer carries electrical supplies, leaving that work to jobbers and contractors. Its rate for energy for residence lighting is 10 cents a kw-hour, with a minimum of 75 cents a month. Short-hour commercial business is subject to the same minimum, but with a 7-cent rate, and the long-hour business is given a 5-cent rate. The rate for

Energy Consumption per Month.	Rates in Cents.
80,000 kw-hours or over	.96
40,000 " "	.99
20,000 " "	1.05
10,000 " "	1.125
5,000 " "	1.25
3,000 " "	1.5
2,000 " "	1.8
1,000 " "	2.25
Less than 1,000 "	3.0

220-volt direct-current energy for motor circuits is 5 cents per kw-hour. For 2200-volt, 60-cycle, three-phase motor circuits the following rate schedule is in force: There is a service charge of $1 per kilowatt per month. For less than

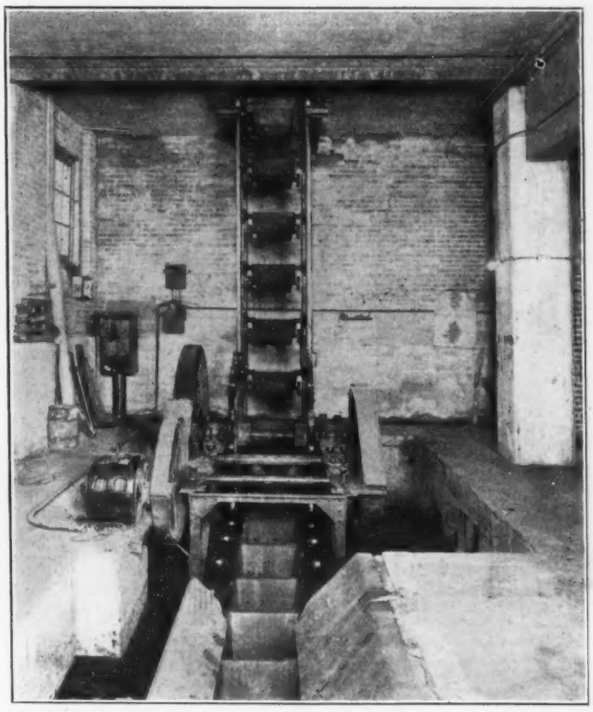


Fig. 6—Motor-Operated Coal Conveyor in Basement.

1000 kw-hours the rate is 3 cents per kw-hour. The other rates are given in the table above.

A discount of 5 per cent is allowed on all bills paid before the tenth of the month.

The meters are read from the 2d to the 28th of the month by two readers, and bills are made out daily but not mailed until the last day of the month. The bills are sent out on post cards and fully 90 per cent of them are paid over the counter. An addressograph is employed in addressing the post cards and this prints in addition the page of the ledger, the line of the light sheet and the number of the card in the margin, as shown herewith. When payment

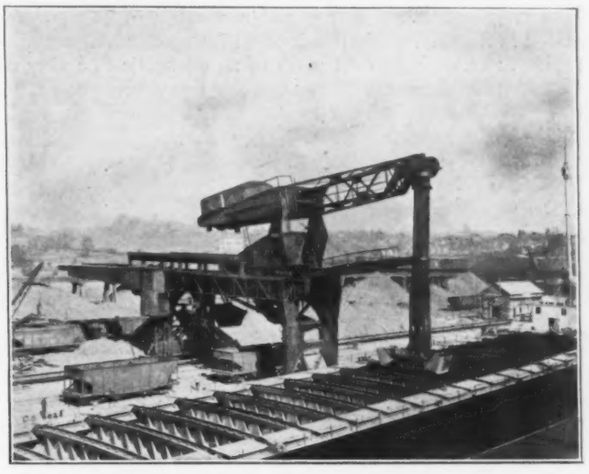
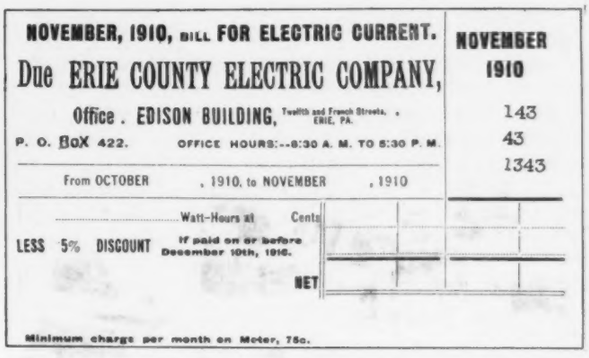


Fig. 7—Electrically Driven Hulett Unloader at Dock at Erie.

is made the card is placed in a machine which receipts it and at the same time chops off the stub at the right end containing the page, line and number, together with the amount. The receipted portion is returned to the customer and the stub serves as a memorandum for the cashier that the bill has been paid, the date being also stamped at the bottom of the stub at the time of payment. By means of the information on the stub the proper entries can be made in the ledger in a minimum time. This system is employed for all accounts.

The company has a number of interesting motor applications fed from its system. One of the largest single installations is that on the Hulett electric ore unloader on the dock of the United States Steel Corporation. There is a 250-hp motor-generator set consisting of a 2200-volt induction motor with flywheel and a 275-volt direct-current generator for supplying energy to the motors. The rated horse-power of the bucket opening and closing motor is 75; the boom hoist, which carries 100 per cent overload, is equipped with a 150-hp motor; for bridge and car haulage an


NOVEMBER, 1910, BILL FOR ELECTRIC CURRENT.

Due ERIE COUNTY ELECTRIC COMPANY,

Office. EDISON BUILDING, Twelfth and French Streets, ERIE, PA.

P. O. BOX 422. OFFICE HOURS:--8:30 A. M. TO 5:30 P. M.

From OCTOBER , 1910, to NOVEMBER , 1910

NOVEMBER 1910

143

43

1343

.....Watt-Hours at ..... Cents

LESS 5% DISCOUNT If paid on or before December 10th, 1910.

NET

Minimum charge per month on Meter, 75c.

Fig. 8—Back of Post Card with Monthly Bill.

80-hp motor is required, and the trolley motors and that for the rotating leg are rated at 50 hp and 25 hp respectively. The load on the installation varies constantly. The bucket lifts 10 tons of ore at a time and can be loaded and unloaded in a minute. The unloader was built by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. Other industrial

establishments using electric motors are as follows: Griswold Manufacturing Company, hardware specialties, 200 kw; Morse Iron Works, iron fittings, 175 hp; A. B. Felgemaker, organs, 40 hp; Erie Malleable Iron Company, iron castings, 700 hp; Lake City Forge & Wrench Company, forgings, 400 hp; Burke Electric Company, dynamos and motors, 200 kw; Williams Tool Company, tools, 70 hp; Holland Manufacturing Company, 30 hp, and a number of others. As stated previously, the motor load on the system is increasing rapidly, and, owing to the work of an energetic Chamber of Commerce, many new industries are being brought to the city which require electricity as a motive power.

The officers of the Erie County Electric Company are as follows: President, Mr. C. H. Strong; secretary, Mr. S. C. Walker; treasurer and general manager, Mr. T. J. O'Dea; superntendent, Mr. E. C. Greene, and chief engineer, Mr. A. J. Gillespie.

JORDAN STREET STATION OF THE UTAH LIGHT & RAILWAY COMPANY.

THE Utah Light & Railway Company supplies practically all the electric service for Salt Lake City, Utah, and during its growth has absorbed a large proportion of the output of the hydroelectric generating and transmission companies which utilize water-powers in the mountain regions surrounding the city. The increase of the business and the somewhat restricted possibilities of the available water-powers have led the management of the company to provide a steam-driven power station, primarily for the purpose of acting as a relay to the various hydroelectric transmission systems and to form a nucleus of such further steam-generating equipment as the future may require. An account of the improvements and additions to the system of the company was published in the *Electrical World*, Nov. 10, 1910. At that time a brief account was given of the Jordan Street station then under construction, and the new underground system, substations and changes in the generating stations and transmission lines were described rather fully.

The presence of coal in the Wasatch Mountains within 40 or 50 miles of Salt Lake City by rail led to an investigation to determine the best site for a steam-driven plant. In July, 1909, after considering the advisability of producer gas as well as steam, and the location of the plant at the coal mine as alternatives, the engineers reported in favor of a steam station to be located preferably on the Jordan River adjacent to Salt Lake City. In the spring of 1910 this report was acted on, and the engineers, Messrs. Westinghouse, Church, Kerr & Company, New York, were authorized to act also as constructors and to proceed with the design and construction of the new power station.

Among the conditions governing the design of this station were the following: Operation not continuous at first, but as a relay to the system; an ample supply of condensing water, unsuitable, however, for boiler feed; feed water to be purchased at a relatively low cost; coal to be brought from mines already developed in Wyoming carrying about 11,700 heat units per pound; power station site being on property owned by the company and having railroad connection.

The fact that the station is intended to be a relay, and not continuously operated, implies a very low load-factor, which called for the exercise of economy in first cost of construction. Accordingly, the building as well as the contained equipment was to be so laid out as to reduce the volume per unit of generating capacity to a very low figure. The cubic contents of the building (which includes ample switchboard room for all the generating equipment it can contain) is 56 cu. ft. per kilowatt of maximum continuous output.

This station is designed on the so-called "unit system," a "unit" comprising a combination of boilers, generating units, condensers and inclosed building, so arranged that it can be uniformly and economically duplicated, and when so duplicated, economically operated either alone or in parallel with the other sections. The boiler-room, which is completely filled with six 600-hp boilers, is of the same length as the turbine-room with its single 10,000-kva turbo-generator, condenser and auxiliaries. It is evident that future needs for greater capacity of this station can be economically met by adding to it one or more units of equipment and inclosing building of the same size as this first one.

The power station building is of brick, with concrete slab floors and roof. The boiler-room includes an overhead coal bunker. This portion of the structure is of skeleton steel construction carrying the greater part of the weight on columns. The turbine-room requires no steel framing other than that needed for the roof trusses, floor beams and crane rails.

The foundation of this station rests upon a pile concrete mattress composed of Oregon fir piles 36 ft. long, spaced 2½ ft. to 3 ft. between centers, overlaid with a practically uniform thickness of 3 ft. of concrete. The condenser intake and overflow flumes, where within the building line, are formed in the concrete foundation. The main flumes ex-

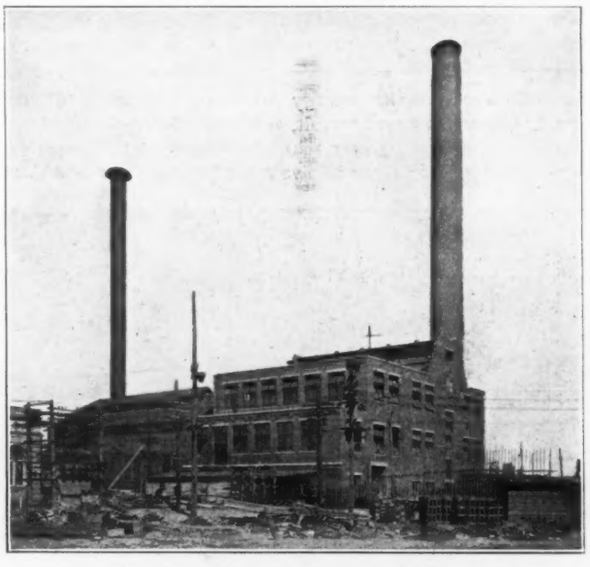


Fig. 1—Exterior of Power Station.

tend from the river bank just outside of and parallel to the building wall, being so placed that they can readily be extended to accommodate future additions to the station, which will be served as in the present case by branches extending from the main flumes into the power station foundations.

Steam is generated in six 600-hp Stirling boilers fitted with the improved Roney stoker operated by natural draft, which is supplied by a single stack. The steam pressure is 200 lb. with 125 deg. superheat. The arrangement of flues and stacks was designed to fit in with the general unit system, which will involve the building of an additional stack for every six boilers added to the plant. The boilers next the turbine-room are provided with a cross flue running just under the coal bunker for connecting them with the stack. By means of a system of skylights placed just below the level of the coal bunker, the firing alley between boilers is provided with far better daylight illumination than is usual.

The load conditions at this plant did not warrant the installation of economizers. The stack is of radial brick, 11½ ft. in diameter and 225 ft. high. Commercial relation-

ship with the management of the mines rendered it unnecessary to make provision for storing coal on a large scale, thus simplifying the problem of transferring the coal from the railroad cars to the stoker hoppers. The cars dump into a track hopper from which coal is carried up by an inclined bucket elevator to the top of the boiler house at one end, where it discharges onto a horizontal belt conveyor by which it is distributed through the bunker over the boilers. The ashes are dumped from the ash pits into side dump cars which run on an industrial railroad in the boiler-room basement and are elevated by a platform lift to the ground level, where they are run out to dump their contents as filling for adjacent land.

The main turbo-generating unit is of 10,000-kva maximum continuous output, with a temperature rise of not to exceed 50 deg. C. The machine is of the Westinghouse-Parsons semi double-flow type of 3600 r.p.m., and generates three-phase, 60-cycle energy at a potential of 4400 volts.

The condensing apparatus is of the mixing type, the LeBlanc condenser being furnished by the Westinghouse Machine Company. Although it has usually been the practice, where feed water has to be purchased, to use a surface condenser, the engineers state that the greater efficiency due to a higher vacuum, combined with the reduced cost of maintenance, more than offsets the increased cost of feed water that has usually accompanied the older forms of mixing condensers.

As is the case with other main features of the power-house equipment, the piping is of distinctly modern design and construction. Pipe flanges for high-pressure steam are welded on, and cast-steel fittings and valve bodies are used. The valve seats, disks and spindles are of "monel" metal. Particular attention is also given to providing for the expansion and contraction inevitable with high-pressure steam and superheat temperatures. The Holly gravity return

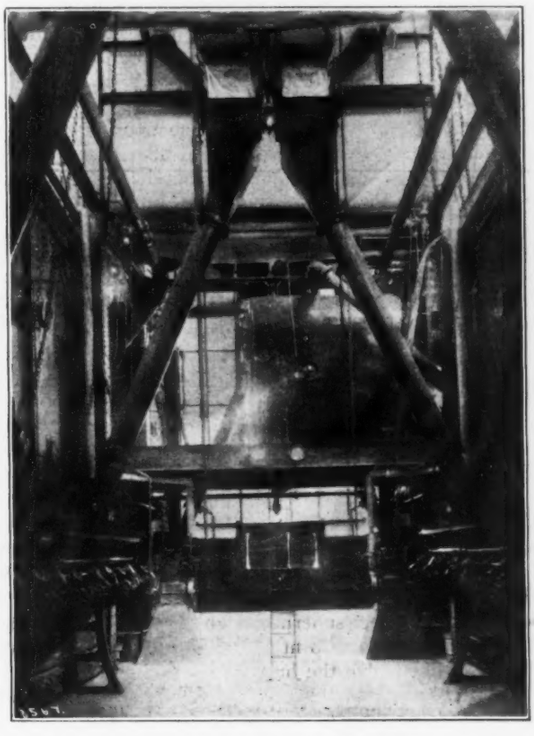


Fig. 2—Interior of Boiler-Room.

system is used in returning condensation in the main steam connections back to the boilers.

The generators are fitted with the usual ventilating ducts. The exciters are of the Westinghouse turbine-driven type of 100-kw rating. The boiler-feed pumps are steam-driven, of the compound duplex pressure pattern. The air and circulating pumps on the LeBlanc condenser are driven by a small steam turbine.

The switchboard apparatus is contained in a cellular structure of the type now so common in high-tension power stations, being in this instance built of solid concrete throughout. The ring type of bus has been adopted as

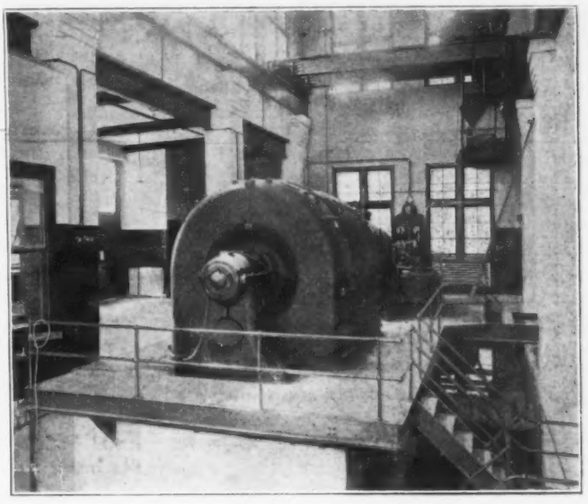


Fig. 3—Interior of Turbine-Room.

offering the greatest flexibility in switching combinations of generators and feeders, with the least number of switches installed. The oil switches are General Electric make, electrically operated from a benchboard of the usual type.

Active construction on the station began about Aug. 19, 1910, upon the arrival of the first carload of piles. By the middle of October the piles were all in and the concrete wall inclosing the basement was well along toward completion. By Nov. 10 the building walls were nearly finished and the stack well under way. By the middle of December the exterior of the building was completed, the windows were in and the stack was finished. Steam was raised in the boilers on Feb. 6, 1911, the turbine was turned over for the first time on Feb. 15 and the station was reported ready to carry commercial load permanently on March 22. The entire work of design and construction was executed by Westinghouse, Church, Kerr & Company, under the direction of the Utah Light & Railway Company officials, Mr. O. A. Honnold, electrical engineer, being in charge of the work for them.

A FEW REASONS WHY HYDROELECTRIC DEVELOPMENT SHOULD BE ENCOURAGED.

By Clarence P. Fowler.

LACK of the fullest knowledge on the part of the government of all of the engineering and commercial considerations surrounding hydroelectric enterprises has been, doubtless, in no small measure responsible for the unfortunate attitude of the former toward the latter.

Capital, like water and electricity, always follows the path of least resistance, and if governmental obstructions are thrown in the way of these beneficial hydroelectric undertakings the inevitable result will be that the funds that would otherwise have been used in their creation and expansion will be diverted to other enterprises which present less risk and upon the investment in which a better return may be reasonably expected. The artificial condition thus created will build up, of course, certain enterprises at the expense of our industrial expansion, which depends so largely for its continued success upon an ample supply of cheap electric energy, such as many of our existing hydroelectric systems have demonstrated their ability

to furnish. Failure on the part of the public to recognize these facts means that our national development will be retarded and unsymmetrical.

It is here interesting to note further the rather marked contrast that prevails between the federal and state governmental treatment of public-service corporations in general, as compared with that accorded other forms of business enterprise. With respect to industries generally, the government is so anxious to promote prosperity that it maintains a protective tariff, and this it does with general public approval. Far from taking any affirmative step to assist our public-service industries, practically all governmental activity has been directed to cutting down their revenues and rendering more difficult the inception or enlargement of their business. Such public servants, however, do not ask any affirmative assistance from the government, but merely request that the latter shall not obstruct any reasonable efforts they may put forth to serve the communities in which their lot may be cast.

Further, it should not be forgotten that while governmental control may proceed to the extremity of public management of public-service corporations' affairs through restrictive legislation and by compelling the highest standards of service at reduced rates, in the face of increasing cost of operation, yet at the same time this governmental jurisdiction cannot compel the investor to put his funds into enterprises which he regards as hazardous, even though the creation and development of such enterprises be for the public good.

Power companies seeking water-power rights are usually treated as supplicants for benefits and advantages instead of being more properly considered in the light of benefactors of the public at large. Because of the public advantages resulting from hydroelectric development, it would seem that the governmental interest in conservation generally should extend to include the conservation of the hydroelectric industry. The question is not, "Should the public encourage such enterprises?" but rather, "Can the public afford to get along without them?"

Water-power development and its governmental control have been the subject of much technical and popular discussion, and will now acquire a much wider interest by reason of the able papers and discussions presented at the recent public conference relating to this topic held under the auspices of the National Electric Light Association, at which there was elicited a large amount of information as to the common good of which hydroelectric development is capable if properly encouraged. In this connection it becomes interesting to review briefly further points which it is believed are worthy of some prominence.

COMPREHENSIVE HYDROELECTRIC SYSTEMS AS A FACTOR IN THE CONSERVATION OF CAPITAL.

Electric generating and transmission apparatus have done much to enhance the value of water-powers to the general public, by rendering them more generally useful than is possible with purely hydraulic works. Owing to their inherent limitations, the development of the latter proceeded somewhat slowly prior to the introduction of electrical equipment, and if proper incentive is to be given the inventor, the financier and the engineer, who have been jointly responsible for the greater availability of our water-powers, then suitable legislation should be enacted which will apply to hydroelectric systems as distinguished from the purely hydraulic works, long since obsolete.

The development of any great water-power usually involves considerable investment, which grows larger as the number of points at which wheels are located increases. If it is endeavored to render water-power available to a large number of users by purely hydraulic means, through the use of a long canal and a large number of wheels and pits, the outlay at once becomes considerably more than that required for comparatively few large wheels grouped together and driving efficient electric generators.

Further, in most instances, it will be found that to be commercially feasible large purely hydraulic systems must be devoted to manufactures on a large scale, with the result that industries requiring power in only limited quantities derive little or no advantage from the development of purely hydraulic works. This stands out in marked contrast with water-power electrically distributed, as with it industries requiring minute and subdivided power can be advantageously supplied, for the reason that it is particularly in connection with such industries that the electric motor has made the greatest headway.

It is therefore seen that hydroelectric development renders it possible for the small manufacturer to share in the advantages of water-power as well as his larger competitor, and, by the reduction in the cost of the otherwise equivalent hydraulic works, conservation of capital results; all of which is beneficial to the public, and in return the public or its representative, the government, owes at least fair treatment to those who have made these benefits possible.

Then, again, with purely hydraulic power systems the locations for manufacturers are very limited in extent. This may result in economic waste in several ways. It frequently happens that water-power sites are occupied by industries whose power requirements equal only a part of the available power, the rest remaining unsold; and, even though the industries located on these sites make use of all the water-power, their limited area creates such a demand for them that they may bring a rental value so high that it wipes out any saving resulting from cheap power. A further inherent drawback in the purely hydraulic plant is that it prevents the sale of power to different consumers at different hours of the day. As most manufacturing plants require power ten hours daily, the water flowing during the night runs to waste, thereby rendering more than one-half of the total energy unavailable, though it would be of considerable value to various industries.

From a review of the above facts it appears that the modern hydroelectric systems operate to prevent the monopolistic use of water-powers, so common in past years, and make possible the subdivision and distribution of these powers into the smallest units, thereby rendering the greatest good to the greatest number. In fact, not only do these hydroelectric enterprises make possible the supply of water-power to a great many small consumers that could not be supplied without them, but through the medium of long-distance electrical transmission several powers on the same stream, or even different streams, may be physically linked together, and with the power of several watercourses so connected, under common control, a great diversity in power demand and supply is thereby secured. Diversity in power demand means the greatest possible use of investment in plant, and, therefore, conservation of capital, which in turn secures to the public better rates. Diversity in power supply often means that it is practicable to match the minimum discharge on one stream with a higher on another or to interchange power of streams having large storage capacity with those having little or none, which increases reliability of power supply and in many cases avoids the use of expensive auxiliary steam power, which also results in advantage to the public in keeping down rates and with common control gives the consumer at one point the advantage of securing water-power from another point, perhaps 200 miles away, when necessity arises.

From the above it is clear that, with reasonable governmental regulation of water-powers, single control of all the powers that may be economically linked into one hydroelectric system tends to benefit not only the companies, but the public as well, as with effective governmental control the need for competition vanishes with all its attendant economic losses, which, if permitted to exist, must be eventually borne either directly or indirectly by the public.

HYDROELECTRIC POWER AS A FACTOR IN PREVENTING ECONOMIC WASTE OF LABOR.

Considerable attention has been justly centered on the wasteful thermal performance of steam prime movers as a source of power, the most economical and modern stations of this type throwing away 90 per cent of the energy in the coal pile during conversion to electrical energy, which waste with an equivalent amount of hydroelectric power can, of course, be entirely eliminated. Intimately related to and hardly less important than the question of fuel conservation is the conservation of labor also made possible through the fullest use of our hydroelectric resources.

National welfare in no small degree depends upon the emcient use of our national resources, as represented in our material and labor, and it requires no argument to show that the higher our efficiency in these respects the more rapidly shall we be enabled to add to our national wealth. In this connection when one stops to consider the vast amount of labor required for mining, distributing, storing, burning and finally removing ashes incident to the use of coal, a large portion of which through hydroelectric development could be set free for the better interests of the country, notably in agriculture, the urgent need for the encouragement of such water-power development at once becomes apparent.

HYDROELECTRIC POWER AS A FACTOR IN PROMOTING OUR INDUSTRIAL WELFARE.

In practically all industries one of the important requirements for successful operation is an ample supply of cheap power, and this need has assumed much greater relative importance in recent years than formerly, due to the transition from hand labor to power-driven machinery. Some idea of the growing importance of power used in manufactures may be gathered from the Bulletin of the United States Department of Commerce and Labor, which records some interesting data on power employed in eleven selected industries typical of the factory method of manufacture. These industries include the manufacture of agricultural implements, boots and shoes, cotton goods, flour and gristmill products, hosiery and knit goods, blast furnaces, steel works and rolling mills, lumber and timber products, paper and wood pulp, silk and silk goods, woolen goods and worsted goods. In all of these industries but two there was a steady rise in the average power used per wage-earner during the thirty-five-year period covered by the report, namely, from 1870 to 1905. During this interval, of those industries which showed any increase none exhibited either a horse-power per wage-earner or a horse-power per $1,000 of products for the year 1905 less than double that in the year 1870, with two industries showing a ratio in these two items for this period as high as five and two others one of three. It is, therefore, evident that development of our water-powers should be pursued with as little delay as possible if we are to maintain our industrial status by keeping pace with our increasing industrial requirements for cheap power, whch does not consume anything that cannot be replaced. In the long run those countries which have available an ample supply of electric power will have a paramount advantage over other countries less fortunately situated, and they must in the end win out in the race for industrial supremacy.

Closely allied with and necessary to the success of the manufacturing industry stands our transportation industry, the power requirements of which for the operation of trains, shops, lighting, etc., are of vast proportions. While there are not, in this country, any examples of very long stretches of trunk-line electrification, yet the successful terminal operation of both direct-current and alternating-current systems under the severe traffic conditions obtaining in the New York zone and also the highly satisfactory results obtained with the electrification of tunnels elsewhere in the United States have proved the feasibility and reliability of electricity as a motive power in heavy railroading.

As demonstrating the reliability of service now attainable with electric traction and its eminent fitness for long-distance trunk-line work, it is important to note that in its report of train operations in New York State during January last the Public Service Commission records the fact that the New York, New Haven & Hartford had 90 per cent of its trains on time, a fact which is especially notable when it is remembered that the single-phase system which is in operation on the New Haven road is handicapped by the necessity for operation of its equipment also over the direct-current zone in order to reach the Grand Central terminal. The unavoidable inference from this would seem to be that if the straight single-phase system were employed (which would be the normal condition in most cases of electrification undertaken) the reliability factor should be still further increased.

One of the drawbacks under which steam-railroad electrification is laboring in all of the cases just referred to is that, owing to the limited extent of route electrified, the most economical results for neither steam nor electricity are realized, and with sufficient traffic density and the electrification of, say, a whole engine district much greater saving may be effected through the use of the new type of motive power, even when operating from steam-driven generating stations.

However, with an ample supply of cheap hydroelectric energy within transmissible reach of at least a portion of our trunk-line roads, and where traffic density conditions warrant, steam-railroad electrification will be stimulated, with its attendant advantages in conserving labor and material.

A brief study will make it clear why hydroelectric systems can afford to sell electric energy to railroads at very attractive rates. Comparatively few hydroelectric enterprises, inclusive of those furnishing no small portion of industrial load, are able to market more than an insignificant portion of the total daily output during the night run. Now, when this is considered in connection with the fact that trunk lines move the greatest proportion of both through freight and passenger traffic over their lines at night, the operation of such railroad systems by electrically transmitted water-power may at once become feasible and thus make possible the use of a large portion of the run-off in our streams that now goes to waste, with the consequent improvement of the load-factor and the resulting low price for energy thereby attainable.

HYDROELECTRIC POWER AS A FACTOR IN PROMOTING OUR AGRICULTURAL WELFARE.

As American progress and prosperity depend mainly on the growth of agricultural production, the importance of increasing the productivity of the soil can hardly be overestimated, and that there is urgent need for more informed methods of seed selection, fertilization and cultivation to attain this end will be realized from the review of a few pertinent statistics, which show not only that our annual yield per acre is low by comparison with other countries, but that our consumption of the products of the nation's farms is rapidly overtaking production. Our farms produce less than 14 bu. of wheat per acre, as compared with 32 in England, 28 in Germany, 34 in the Netherlands. For oats the United States produces 23 bu. per acre, while England produces 42, Germany 46 and the Netherlands 53. Then, again, in 1908 our exports of the principal cereals had fallen 72 per cent as compared with out exports ten years previous, and based on past records, if the converging lines of production and consumption continue to approach each other as in the past ten years, one of our eminent authorities estimates that before very long we shall have become a food-importing nation, with all of its disadvantages. One of the ways of ameliorating this unfortunate nation-wide condition is by the application of artificial fertilizer to the soil. Recently addressing the New

England Railway Club on the commercial feasibility as also the necessity for soil fertilization, President Brown, of the New York Central Railroad, said: "In the past there was little incentive to fertilize the soil by the use of commercial fertilizers, whereas now these expenditures pay one-hundredfold." Till within the last few years the only commercial available sources of artificial fertilizers have been the Chili saltpeter deposits, the island guano deposits and the by-products of gas works. The first two of these must ultimately become exhausted and the present yield of the third is entirely inadequate to meet the nation's requirements. It is evident, therefore, that there is urgent demand for additional sources of artificial fertilizer supply, and relief from impending famine in this commodity, in the shape of fixed atmospheric nitrogen, would be commercially possible with an ample supply of cheap electric energy available, as the chief item of expense in the manufacture of this soil-recuperating agent is the cost of energy. The low rates possible for off-peak and secondary energy from hydroelectric plants turn to useful account energy that might otherwise be wasted, and at once make this process a commercial success. That this method of producing artificial fertilizer has passed the experimental stage will be appreciated when it is remembered that European hydroelectric plants having an aggregate rating of 100,000 hp are already successfully applied to this process.

Another menace to agriculture is found in the general tendencies of the rural and agricultural part of the population to concentrate in larger urban centers. The percentage of our population who work on the farm constantly declines. In 1790 only about 3.4 per cent of the American people lived in towns, whereas in 1900 more than 31 per cent of our population was urban, and it is expected that the last census will show even greater tendencies in this direction. There seem to be strong reasons for believing that, at least with farms which are not too scattered and with hydroelectric energy to be had at reasonable rates, it will be commercially feasible to group several farms together in such a manner that the general use of electricity will play no small part in rendering farm life more attractive and tend to check the continued exodus of the rural part of our population to the cities, as shown by the statistics given above.

CONCLUSION.

Summing up, it appears from a review of the facts cited above that the hydroelectric development of the water-power in our watercourses is destined to play no mean part in aiding our industrial and agricultural well-being—in short, in preserving and advancing our national status—and it is, therefore, not only the duty but the privilege of the government to see to it, without undue delay, that all reasonable encouragement be accorded private capital, which, with positive assurance of rational legislation, stands ready to bring about the fullest realization of these hydroelectric opportunities.

DATA OF TRANSMISSION LINES IN CHICAGO.

At the late Chicago convention of the American Institute of Electrical Engineers the Commonwealth Edison Company gave in succinct form some technical data on its principal generating stations and transmission systems. Fisk and Quarry Street stations were described briefly, as well as the new Northwest station, two units of which will be placed in operation in September probably. In addition data were given on the transmission lines of the system corrected to the fall of 1911 and embracing the initial equipment of Northwest station.

It may be explained that there are three separate parts in the system of high-tension transmission lines connecting the Fisk Street and Quarry Street generating stations with the fifty-three substations from which distribution is accomplished.

The most important of the three is the 9000-volt, 25-cycle system, which carries by far the largest portion of the generated output, supplying all of the company's substations and also the railway substations. It consists of some 450 miles of high-tension cable extending north to Evanston, Ill., and south to Hammond, Ind.

The lines radiating from Fisk Street supply the north and west territory, and those from Quarry Street the south side of the city chiefly, including the traction substations.

The long range portion of the 25-cycle system is operated at 20,000 volts and is derived from the 9000-volt system through three 5000-kw transformers. It consists of four lines, two supplying Grand Crossing, South Chicago, Roseland and Hammond, and two extending to Evanston, where they connect with the systems of the North Shore Electric Company and the Chicago & Milwaukee Electric Railway.

The third portion is the 12,000-volt, 60-cycle system. Previous to 1910 a portion of the 60-cycle, 4000-volt distribution system supplying some large industrial motor customers had been fed from the 9000-volt, 25-cycle transmission system through frequency changers. This load increased to something like 27,000 kw, and consequently two 60-cycle generating units at Quarry Street were installed and the 12,000-volt transmission system was inagurated.

All told there are 130 transmission lines, with a total length of approximately 525 miles.

At least two lines are provided for nearly every substation.

The direct control of the system is vested in the load dispatcher's office, which for purposes of ready intercommunication is equipped with a private telephone system connecting it directly with all stations and substations.

In this office is the load dispatcher's board, white-enameled and showing diagrammatically every generator, line and switch in the three systems, excepting converting-unit switches. Plugs are used to indicate oil switches open and closed. The absolute conditions are thus constantly

TRANSMISSION-LINE DATA, CHICAGO.

		9000 Volts.	12,000 Volts.	20,000 Volts.
No. of direct lines	From Fisk Street station	56		4
	" Quarry Street station	25	17	
	" Harrison Street station	9		
	" Northwest station	16		
No. of tie lines		24	4	5
Average length of tie lines		1.3 miles	2.4 miles	3.2 miles
No. of company substations supplied		*29	†13	‡5
No. of railway substations suppied		18		2
Average length of direct lines		3.6 miles	4.2 miles	12.5 miles
Size of wire, B. & S. and circ. mil.		No. 4-0 and 250,000	No. 4-0 and 250,000	No. 2-0
Average maximum load per line, company (winter months)		2000 kw	2500 kw	Combined 3,800 kw
Average maximum load per line, railway (winter months)		2200 kw		
Total maximum load (non-coincident)		155,000 kw (including transformers on 20,000-volt system).	23,900 kw (November, 1910)	Included in 9000-volt load

* Includes combination 60-cycle, 12,000-volt and 25-cycle, 9000-volt substation.
† Includes Crane Company, Grove Street, Bridgeport, and combination 9000-12,000-volt substations.
‡ Includes combination railway and Edison and two North Shore Electric Company stations.

indicated. To supplement this board, which shows practically no detail of the substations, another map is used.

The following table shows at a glance the principal statistics of the transmission lines of the Commonwealth Edison Company as they will be after the initial equipment of Northwest station is in operation:

For distribution the Commonwealth Edison Company employs direct current in a central area of about 10 sq. miles and three-phase, 60-cycle alternating current in the remainder of the city. The direct-current area is supplied from twenty-two converter substations (thirteen of which have auxiliary batteries), three exclusively battery substations, and one direct-current generating station (Harrison Street). The standard sizes for feeders in this territory are 1,000,000 circ. mil and 1,500,000 circ. mil. These feeders connect with an intricate network of direct-current mains at various points, the whole system being tied together at street intersections.

The three-phase, 60-cycle system, which covers a far more extensive territory, is not thus interconnected, but consists of separate four-wire circuits with open emergency centers for tying in in case of trouble. It radiates from and is supplied by ten substations with 2000-4000 volts on the primaries, the service pressure being stepped down to 115-230 volts by line transformers installed where required.

NOTES ON THE LOADING OF TELEPHONE CABLE AND OPEN-WIRE CIRCUITS.

By Samuel R. Parker and J. Cavers.

THE subject of loading or inserting inductance to improve transmission over long-distance circuits, whether for telephone or telegraph work or for power transmission, is not new, Mr. Oliver Heaviside having gone into it theoretically in 1887. From that date, however, no practical steps of importance were taken to work out the theory of loading until Prof. M. I. Pupin, in 1899, showed from actual tests the feasibility of installing series inductance coils on working lines to improve their transmission. Although the subject of loading has come prominently to the front in recent years, information on it is very scattered and the object of these notes is to show why loading improves the transmission, and also some of the methods of calculation for obtaining the best results on various circuits.

The efficiency and limiting distance of speech of the telephonic circuit for long-distance transmission depend on the magnitude and mutual relations of the following electrical quantities, namely, capacity, inductance, resistance and leakage conductance. The essential difference between long-distance and short-distance transmission is that on long lines the electrical speech impulses are transmitted in the form of elastic undulations of electromagnetic waves, while on short lines the reflection of the impulse at the terminal instruments interfering with the advance of the wave crest prevents these waves from forming.

As each sound or word transmitted over the telephonic circuit has a definite frequency, amplitude and wave form, it will be readily seen that the speech impulses take the form of a very complicated number of superposed vibrations or waves of different frequencies. These impulses as they progress along the line are subjected to two deteriorating influences, namely, attenuation and distortion, the quality of the speech transmitted depending on how the frequency or pitch, amplitude or volume and wave form or timbre of the sound (which affects the articulation) are reduced or changed by these two deteriorating influences.

The frequency is the number of complete reversals per second of the alternating current, a complete reversal being understood to take place when the current gradually rises from zero to a positive maximum, falls to zero, increases to a negative maximum, and again falls to zero. This is known as a cycle or period. The amplitude is the extent of the vibration from the zero line, and the wave form is the shape of the curve in passing through a complete cycle or period.

The attenuation of the wave is a falling away of the amplitude due to a certain amount of energy being dissipated by the ohmic resistance (I^2R), by the shunting effect of leakage from the line, and by the reaction from the inductive action upon surrounding bodies, such as losses due to eddy currents and hysteresis losses if there are any iron bodies or circuits in the vicinity. Eddy currents and hysteresis losses react on the circuit in the same way as resistance, and can be represented as an addition to the ordinary resistance of the circuit measured under steady current conditions. Attenuation in itself is not harmful if not carried too far, as a receiver will convey an intelligible conversation when the amplitude is reduced to 1 per cent if there is no distortion of the wave form.

Distortion is due to the capacity and inductance of the cable or wires affecting unequally the waves of different frequencies composing the speech impulses, thus altering the relative position and proportion of the subsidiary waves, which in long distances causes the wave form or special quality or timbre of the sound to be lost and the words to become indistinguishable, even though the volume of the sound may be large.

The effect of capacity on transmission is that while the undulation of the speech wave is rising and falling the circuit is charged and discharged, this discharge driving back the current and causing a lead in phase. Capacity causes retardation in the speed of transmission, introducing a time element. It also levels down the higher periodicities of the waves, so that in lines of high capacity the waves of high pitch may be wiped out altogether and only low-pitched sounds transmitted correctly, the character of the sound received being altogether different from that impressed on the transmitter.

The effect of inductance on transmission is very similar to that of capacity, being to create a field in the surrounding dielectric which rises and falls in intensity with the undulations of the speech wave, thus setting up induced charges in the circuit. Inductance may be represented as the inertia of the circuit, and tends to prevent any rapid changes in the transmitted wave, driving forward the current and causing a lag in phase.

Thus while capacity produces a lead in the resultant wave, any phase in the resultant wave being earlier than a similar phase in the impressed alternating emf, inductance causes a lag, any phase in the resulting wave being later than a similar phase in the impressed alternating emf. Capacity and inductance are not dissipative like resistance and leakage conductance, as neither of them reduces the energy of the transmitted current.

The theory of loading is so to balance inductance and capacity in a circuit that they neutralize each other, and, as all actual telephone circuits contain far more capacity than inductance, it will be necessary to introduce more inductance into the circuits.

A circuit in which inductance completely neutralizes capacity at all periodicities is distortionless, and the speech impulses are subject only to attenuation—that is, in an ideal circuit of this kind, the speech wave at the receiving station would be an exact reproduction of the speech wave at the transmitting station, with a reduced amplitude depending on the distance between the two stations and the resistance and leakage conductance of the circuit.

A complete balance between capacity and inductance for any one periodicity can be obtained when the resultant wave produced by capacity leads the impressed emf by 90 deg. and that produced by inductance lags 90 deg. behind the impressed emf. As this result is impossible to obtain in practice, the same effect is obtained if the angle

of lead exactly equals the angle of lag, but separated by 180 deg. or π radians. This will be readily seen, as the distorting effects due to capacity and inductance will have their maximum and zero values at the same points, but with opposite signs—that is, when the distorting capacity effect is at a positive maximum the distorting inductive effect will be at a negative maximum, and the impressed emf for any one frequency will be in phase with the current, thus giving the best efficiency.

As capacity is evenly distributed along the line, to neutralize it inductance must be as evenly distributed as possible. If large amounts of inductance are cut into the line at long distances apart they merely act as choking coils. To get the best results the inductance should be introduced into the circuit at certain short predetermined intervals, depending on the wave length. From experimental tests it has been found that where the wave front passes from 7000 coils to 13,000 coils per second very good results have been obtained. Professor Pupin has worked out a mathematical formula by means of which he is enabled to determine the maximum distances apart which the added balancing coils joined in series to the line should be placed, in order to approximate in efficiency to an equal uniformly distributed inductance.

The theoretically perfect loading coil should have the same effective resistance for all essential periodicities of the telephonic wave to eliminate the distortion in the coil. Such a coil cannot be obtained in practice. The coil must have a certain inductance and must consist of several turns of wire. To reduce attenuation the resistance must be kept as low as possible, a few turns of large-gage copper wire being used. A reduction in the turns, and so in the resistance, can be most easily effected by introducing an iron core. If the coil is entirely of copper the effective resistance for frequencies within the range of telephonic periodicities will correspond to the loss due to eddy currents in the copper; if the core is of iron or other magnetic material additional losses will be introduced due to eddy currents in the core, as well as hysteresis losses in the iron, which will augment the difference between the actual resistance and the effective resistance. As it is impossible to eliminate these losses, the effective resistance will vary at different periodicities and produce distortion losses in the transmitted wave.

Practical and commercial reasons demand that an iron or other magnetic core be used, and as the tendency of the higher effective resistance of the iron-cored coils is only to suppress and reduce the higher periodicities of the voice wave, which is found not appreciably to affect the quality or intelligibility of transmission, the advantage of a wholly copper coil is not markedly noticeable. The best coil to use is one that gives the required inductance with the largest time constant (L/R), together with the smallest size.

In loading a line several considerations have to be borne in mind. The velocity ($V = \omega/\alpha$) with which electromagnetic waves are propagated over a line may vary from 1 in. or less to 186,000 miles per second (velocity of light), depending on the values of R, C and L. The greater the value of L the less the velocity, and, as the wave length equals velocity divided by periodicity ($\lambda = V/f$), the shorter the wave length for any one frequency of alternation. But when the wave length is small the number of coils for any given length will be large, as every wave length has to be loaded with a certain number of coils to get the best efficiency, thus making the cost of loading prohibitive. For this reason when loading a line the greatest amount of attenuation to be allowed on a line, or the coefficient of attenuation, should be determined and L calculated to give this attenuation, thus giving the greatest efficiency with the least added inductance, therefore the greatest wave length and the least number of coils. This method does not make the line distortionless by any means, as the inductance added does not completely balance capacity, but even a small amount of inductance will reduce the unbalanced distorting effect of capacity provided the distorting effect of the coils is small.

Another point is that where the coils are not evenly spaced the efficiency of the line is reduced very appreciably, due to reflection between the coils. In loading underground cables where the manholes are not evenly spaced, preventing the coils from being evenly distributed, this will cause considerable loss. If l equals the distance between coils the first and last coil on a loaded line should be placed $0.5\,l$ miles from each end, thus giving the line a tapered effect and also keeping the spacing even if at any time it is desired to join two loaded lines in series.

One of the difficulties encountered on loaded lines is terminal loss, due to the reflection of the speech impulse at points of non-uniformity in the line, such as a point where a loaded aerial circuit is joined to a cable or vice versa. It has been suggested that by tapering the coils this can be overcome, tapering being to reduce the inductance gradually at both ends of the line, keeping the spacing of the coils the same. The best efficiency is then obtained when the ratio L/C for the loaded line equals the ratio L/C for the unloaded line. Theoretically reflection can be overcome in cases like this by having a perfect transformer at each point of non-uniformity in the line.

Reflection also takes place at points where the instruments are bridged directly across a loaded line. It has been claimed that transmitting instruments for loaded lines should have a higher impedance than those for non-loaded circuits. The advantage of using apparatus of a higher impedance for loaded lines is most readily seen when considering the transmitter-end impedance of a very long overhead line, the impedance of such a line being $L\omega$, where ω is the angular velocity, or 2π times the frequency, and L is the inductance per loop-mile in henries. For unloaded lines this impedance is from 600 ohms to 700 ohms, but for loaded lines, seeing that inductance has been added, this figure should be greater. The transmitting apparatus in present use has been adopted for unloaded lines, and where loaded lines are used it is suggested that if instruments of a higher impedance were installed the transmission over short distances would be greatly improved.

The amount of inductance necessary completely to balance capacity at a frequency of about 800 cycles per second on aerial wires is roughly 4.4 henries and that for cables about 0.5 henry per mile. From these figures it will be seen that for any given amount of added inductance the increased efficiency of the cable will be much greater than that of the aerial wires.

Coming now to a consideration of some of the methods of calculation for obtaining the best results on various circuits, the first point to be considered is what frequency can be taken as representing the average for all speech waves.

In the discussion on a paper on "Loaded Telephone Lines in Practice," read before the Electrical Congress at St. Louis in 1904 by Dr. H. V. Hayes, it was shown that an underground telephone circuit, when used for transmitting speech waves having frequencies ranging from 100 cycles to 2000 cycles per second, behaves in regard to attenuation as though it were operated at a single frequency of 800 cycles per second, or an angular velocity of 5025 radians per second. This means that under telephonic conditions the circuit behaves as though the speaker's voice had a single frequency of 800 cycles per second.

In an alternating-current circuit the difference of potential Pd between the wires of a loop at d miles is equal to the difference of potential at the sending end Po times $e^{-\beta d}$, and Pd lags behind Po by an angle αd. The greater the distance the greater will be this angle of lag till a point is reached where the difference of potential is one complete cycle behind that of the impressed voltage Po. Since the

phase changes uniformly with the distance, it follows that the waves are traveling along the circuit with a constant velocity; therefore, when the phase has been delayed one period αd equals 2π or d equals $2\pi/\alpha$.

The meanings of the symbols used in these discussions are as follows:

R is the resistance per loop-mile in ohms,
S is the leakage conductance per loop-mile in mhos,
C is the mutual capacity per loop-mile in farads,
L is the inductance per loop-mile in henries,
f is the frequency or periods per second,
ω is the angular velocity in radians per second,
e is the base of the Naperian or natural logarithms (2.718),
v is the velocity of light in miles per second,
V is the velocity of waves in miles per second,
d is the distance in miles,
l is the distance between coils in miles,
α is the velocity constant,
β is the attenuation constant,
λ is the wave length in miles, and
π is the ratio of the circumference to the diameter (3.1416).

When f periods have been passed through by Po, $(f-1)$ periods will have been passed through Pd where the phase has lagged one period. Then V, the velocity of the wave, equals d/t, t being the time of one period. If there are f periods per second, t equals $1/f$, therefore v equals $d \div 1/f$ equals $2\pi/f\alpha$. But the wave length λ equals velocity divided by periodicity, (V/f) or $2\pi/\alpha$, showing that the wave length is the distance at which the phase has been delayed by one period.

The letters α and β stand for constants, the value of α being $[\frac{1}{2}\{(R^2+\omega^2L^2)(S^2+\omega^2C^2)\}^{\frac{1}{2}}-\frac{1}{2}(RS-\omega^2CL)]^{\frac{1}{2}}$ and is the velocity constant; the value of β being $[\frac{1}{2}\{(R^2+\omega^2L^2)(S^2+\omega^2C^2)\}^{\frac{1}{2}}+\frac{1}{2}(RS-\omega^2CL)]^{\frac{1}{2}}$, which is the expression for the attenuation constant. It is not proposed to prove the formula used for these two constants, as they will be found in Mr. Oliver Heaviside's "Electrical Papers," Vol. II.

As the expressions for the constants α and β are somewhat unwieldly it is proposed to simplify them as much as possible.

As the leakage conductance for aerial wires would not be more than 1×10^{-6} and for cable not more than 1×10^{-7}, S can be neglected, which reduces these constants to:

$$\alpha=[\tfrac{1}{2}\omega C\{(R^2+\omega^2L^2)^{\frac{1}{2}}+\omega L\}]^{\frac{1}{2}} \qquad (1)$$

and

$$\beta=[\tfrac{1}{2}\omega C\{(R^2+\omega^2L^2)^{\frac{1}{2}}-\omega L\}]^{\frac{1}{2}} \qquad (1)$$

In aerial wires, where the resistance is small compared to ωL, these will be simplified still further.

Expanding $(\omega^2L^2+R^2)^{\frac{1}{2}}$ by the binomial theorem, the expression equals $\omega L\,(1+\frac{\frac{1}{2}R^2}{\omega^2L^2}+\text{etc.})$, the remaining terms being neglected, as ωL is large compared with R. This expression then reduces to $\omega L+R^2/2\omega L$. Substituting this value for $(\omega^2L^2+R^2)^{\frac{1}{2}}$ in equation (1), for α and β we get:

$$\alpha=\{\tfrac{1}{2}\omega C\,(\omega L+R^2/2\omega L+\omega L)\}^{\frac{1}{2}}=(\tfrac{1}{2}\omega C\times 2\omega L)^{\frac{1}{2}}$$

The term $R^2/2\omega L$ can be neglected.

Therefore,

$$\alpha=(\omega^2CL)^{\frac{1}{2}}=\omega\,(CL)^{\frac{1}{2}} \qquad (2)$$

$$\beta=\{\tfrac{1}{2}\omega C\,(\omega L+R^2/2\omega L-\omega L)\}^{\frac{1}{2}}=(\tfrac{1}{2}\omega C\times R^2/2\omega L)^{\frac{1}{2}}$$

therefore,

$$\beta=\left(\frac{CR^2}{4L}\right)^{\frac{1}{2}}=\frac{R}{2}\left(\frac{C}{L}\right)^{\frac{1}{2}} \qquad (2)$$

In an unloaded cable where ωL is small compared with R $(R^2+\omega^2L^2)^{\frac{1}{2}}$ equals approximately R, and $R\pm\omega L$ equals approximately R.

Then α and β equal approximately $(\frac{1}{2}\omega CR)^{\frac{1}{2}}$ (3)

(These results are, however, not correct to within 5 per cent.)

In a loaded cable ωL cannot be neglected, and equation (1) must be used for α and either (1) or (2) for β.

The attenuation factor is $e^{-\beta d}$. From this the amplitude can be calculated at any distance. Assuming the amplitude to be 1 to begin with, at d miles it will be $1/e^{\beta d}$.

To find the balancing inductance for any circuit, by treating the speech wave as a simple alternating current having a frequency of 800 cycles per second, the angle of lag, Θ, due to inductance is such that $\tan\Theta=\omega LI/RI=\omega L/R$, the reactance being ωL and the impedance $(R^2+\omega^2L^2)^{\frac{1}{2}}$. Capacity, instead of prolonging the current, drives it back, producing a lead in phase which is such that $\tan\Theta=-1/\omega CR$, the reactance being $-1/\omega C$ and the impedance being $(R^2+1/\omega^2C^2)^{\frac{1}{2}}$. Where inductance and capacity are both present, as in a telephone circuit, $\tan\Theta=(\omega L-1/\omega C)/R$, the reactance being $\omega L-1/\omega C$ and the impedance $\{R^2+(\omega L-1/\omega C)^2\}^{\frac{1}{2}}$.

But as capacity and inductance produce opposite effects they neutralize each other when $\omega L-1/\omega C=0$ or when $\omega L=1/\omega C$. Therefore L (the balancing inductance for any one periodicity) $=1/\omega^2C$. When this balance is set up the circuit is non-inductive and the current simply obeys Ohm's law—that is, only attenuation takes place, the circuit being distortionless. But as the periodicity of a telephonic speech wave is not constant, varying from 100 to 2000 and more, the divisor ω^2C will vary, thus changing L. From this it will be seen that under no conditions can a telephonic circuit be made absolutely distortionless.

Seeing from this that it is absolutely impossible to get a distortionless wave for all periods common to telephonic speech, these figures for L, where it equals $1/\omega^2C$, can be taken as the limiting values for loading, the efficiency decreasing beyond this and the distorting effect being a purely inductive one.

But in telephone practice all that is required is a certain standard of transmission, there being no object in increasing the efficiency beyond that point. A definite standard of transmission is represented by a definite attenuation constant β. This does not take into account the articulation, but merely the volume of sound transmitted.

Taking, for example, a 500-mile aerial line, say it is wished to have an attenuation constant of 0.014; then taking equation (2) for $\beta=R/2(C/L)^{\frac{1}{2}}=0.014$; then L, the total inductance per loop-mile, equals $(R+R_c)^2\times C/4\times0.014$, where R_c is the apparent resistance of the coils at 800 cycles per second, the amplitude at the distant end being $e^{-0.014d}=1/e^{0.014d}$.

Taking another example:

To find the amount of inductance to be added so that the speaking efficiency of a No. 8 B. W. G. copper circuit at 1600 miles will equal the unloaded speaking efficiency at 1200 miles (which is approximately the limiting distance for speech).

The attenuation constant for 1200 miles equals approximately 3.3×10^{-3}; therefore the attenuation constant β necessary at 1600 miles to give the same speaking efficiency equals

$$3.3\times\frac{1200}{1600\times10^3}=\frac{39.6}{16\times10^3}=2.84\times10^{-3}$$

and taking $\beta=R/2\,(C/L)^{\frac{1}{2}}=0.00284$; $L=(R+R_c)^2\times C/4\times0.00284$ henry.

The amplitude at the distant end equals $e^{-\beta d}=e^{-0.00284\times1600}=e^{-4.5}=1/e^{4.5}=1/90=0.0111=1.11$ per cent of transmitting-end amplitude.

From these figures it will be seen that R_c, the apparent resistance of the coils, greatly affects the value of β and thus, although loading improves the articulation, it reduces the volume of the sound, or the amplitude, and as the value R_c increases with the inductance of the coils it will be

readily seen that if a line is overloaded, or loaded more than absolutely necessary to get the standard of transmission required, the efficiency of the circuit is reduced instead of increased for long-distance transmission. For if the amplitude **is reduced too far, although the** articulation is good, telephonically speaking, the circuit will be inefficient. When the value of βd is such that $e^{-\beta d} = 100$, or $\beta d = 4.60511$, the limiting point at which loading is commercially of value has been reached.

From this it will be easy to calculate the most economical

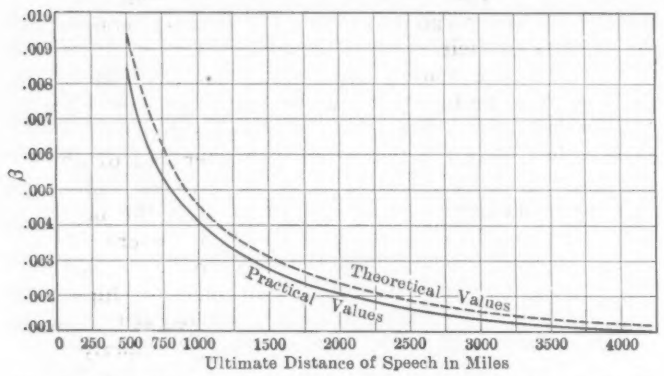


Fig. 1—Theoretical and Practical Values of β for Ultimate Speech Distance in Aerial Circuits.

value of β and thus the right amount of loading necessary to cut into a circuit of any given length to give the best efficiency. The best efficiency is obtained when $\beta = 4.60511/d$. From this it will be easy to calculate L, d in this case being the limiting distance for which the circuit is designed.

Considering now the best spacing for the coils, Professor Pupin has worked out a formula for the maximum spacing per wave length to give approximately the same efficiency as uniformly distributed inductance.

If the wave length be taken as a complete revolution, 360 deg., or in angular measure 2π radians, and the length l, the fraction of a wave-length between any two coils, be given in angular measure $= 2\pi l/\lambda$; then the nearness with which $\frac{1}{2}\sin 2\pi l/\lambda$ approximates to $\frac{1}{2}2\pi l/\lambda$ radians will represent the approximation of the efficiency of the loaded line to that of a line in which an inductance of equal value is spread uniformly over the line .

When $l/\lambda = 0.1$, then $\frac{1}{2}\sin 2\pi l/\lambda$ equals $\pi l/\lambda$. So that the best efficiency is obtained when there are ten coils per wave length.

From experimental results it has been found that 7000/800, or 8.8, coils are the least that should be used per

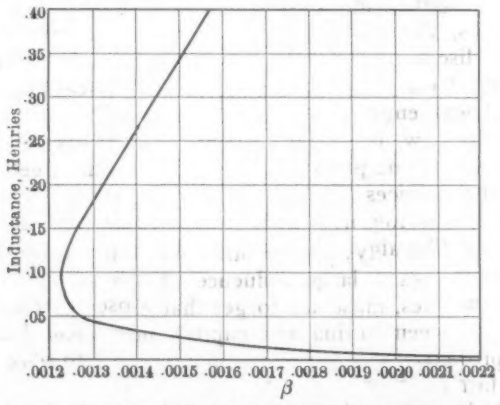


Fig. 2—Curve Showing Inductance Required to Give Values of β for No. 8 Circuit (3.95 Ohms for Loop-Mile).

wave length, and that there is no advantage in putting in more than 13000/800, or 16.2, coils per wave length. These results agree with the above calculated result.

The only other formulas necessary are those for finding the inductance and capacity of aerial lines, those for cable always being known, as they are manufactured to set standards. In this case for aerial lines L has been taken as equal to $0.1609 + 1.482 \log_{10}(2h/d) \times 10^{-3}$ henries, and C as equal to $0.0194\ lk/\log_{10}(2h/d) \times 10^{-6}$ farads. Five per cent should be added to this result to allow for the reaction of the adjacent wires.

In these formulas

h = distance apart of wires in inches.
d = diameter of wires in inches.
k = specific inductive capacity of dielectric between conductors (for air equals 1).
l = length in miles.

The only other point to be considered is the apparent re-

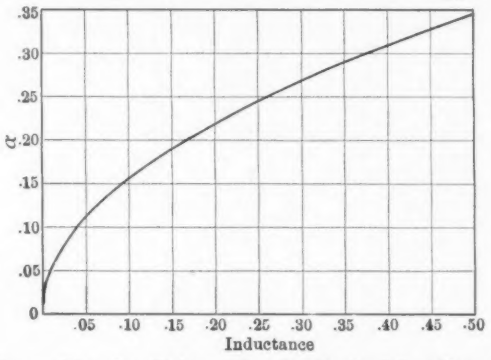


Fig. 3—Curve Showing Values of α for Desired Loading of No. 8 Circuit.

sistance of the coils at different frequencies. These coils are manufactured under patent held by the American Telephone & Telegraph Company in America and by Siemens & Halske in Europe, but little information is to be had regarding their characteristics. Although manufactured under patent and sold by the Western Electric Company in five stock sizes, coded as 501 and 503 for aerial work, and 506, 507 and 508 for underground work, no bulletin is issued with them. But it may be taken as correct that these coils are wound upon rings of magnetic material and have, practically speaking, no external field, consequently they can be incased in metal. Provided there is a thin iron shielding plate between them to provide against electrostatic and electromagnetic action, they may be packed on top of one another without any fear of induction between themselves or from other outside sources.

The above-mentioned coils have a time constant of about 0.240 (L/Rc), so that, L being known, the apparent resistance at 800 cycles per second can be calculated. A coil

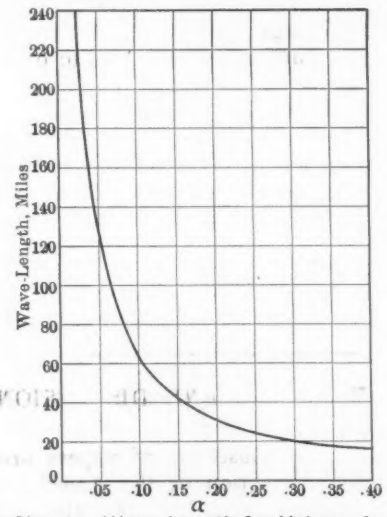


Fig. 4—Curve Showing Wave-Length for Values of α on All Aerial Circuits.

having an inductance of 0.252 henry has an apparent resistance of 10.5 ohms at 800 cycles, and a coil with an inductance of 0.133 henry has an apparent resistance of 5.5 ohms approximately (Western Electric Company's coil, code No. 507).

Summarizing the above results, it has been shown that no matter how heavily a circuit may be loaded it is im-

possible to make it distortionless for all periodicities required in telephonic speech. This being the case, the circuit will give the best efficiency when it is loaded just sufficiently to give the required transmission for the ultimate distance for which it is designed. To get this result if d equals this distance in miles, theoretically β should equal $4.60511/d$, but in practice this value of β has to be reduced approximately 10 per cent to allow for extraordinary losses, such as leakage, eddy currents and hysteresis losses, which exist on the circuit, but which cannot be calculated. This value for β approximates very closely to the values calculated for the limiting distance of speech for metallic circuits of various gages.

From equation (1) or (2) for β, the value of β being known, L can be calculated.

The values of L, C and R (resistance of mile of circuit plus apparent resistance of coils per mile) being now known, α can be calculated, using equation (1) for cable and equation (2) for aerial wires.

From this we get the wave-length, and the distance between coils, l, equals 1/10 of the wave-length.

The required inductance per loop-mile being L, the inductance of each coil should be $L/2 \times l$. If there are no coils having this inductance the coil with the next lowest inductance should be used, and the distance l reduced so as to get the required added inductance per wave-length.

With this information before him the engineer will be in a position to determine whether more economical results will be obtained by loading an existing circuit or installing a circuit of somewhat heavier gage.

It is of considerable importance that the insulation resistance of a loaded line should be kept good, as, the velocity being reduced, the attenuation of the current due to leakage conductance will be considerably increased.

Fig. 1 shows the different practical (β equals $4.1446/d$) and theoretical (β equals $4.60511/d$) calculated values for β, as the ultimate distance of speech increases from 500 to 4200 miles. This curve is applicable to all aerial circuits.

Fig. 2 shows the amount of inductance required to give any definite value of β.

This curve is plotted for a No. 8 Birmingham wire-gage circuit, strung 12 in. apart. The critical point of this curve is reached when 0.10 henry has been added per loop-mile, and, although theoretically 4.2 henries should be added to get a resonant circuit at 800 cycles per second, the added apparent resistance of the coils attenuates the current so much that the advantage gained in distinctness is lost in volume after the circuit has been loaded to 0.10 henry per loop-mile.

This curve only applies to an 8 B. W. G. circuit strung under the above conditions; for other circuits a similar curve should be plotted and the critical value determined.

Fig. 3 shows the value of α for any given amount of loading for a No. 8 circuit; for other sizes similar curves should be plotted.

Fig. 4 shows the wave-length and the distance between coils for any given value of α. This curve applies to all aerial circuits.

A. I. E. E. PAPERS AND DISCUSSIONS.

Following are further abstracts of papers presented at the recent Chicago convention of the American Institute of Electrical Engineers, together with abstracts of the discussions to which they gave rise.

MAKING APPRAISALS.

The paper by Mr. H. M. Byllesby, Chicago, entitled "Important Features Entering Into Making of Appraisals" opens with a sketch of electrical development during the past thirty years or more, after which the subject of public service franchises is discussed. The great expansion of the electrical industry in this country is ascribed partly to the liberal franchise grants issued in the past and the freedom from onerous restrictions, both for the occupancy of streets and the purchase and development of water-powers, united with a broad liberal construction which has justified the issuance of stock which would eventually make for the projectors and developers of these enterprises, when they become successful, something in advance and beyond a mere fair interest return on their investments. At the present time both the public and the corporation are reaching a common meeting ground, whereby public service corporations become regulated monopolies, governed as to their rates and protected from competition by public service commissions. Mr. Byllesby states that with this doctrine the public service engineer and operator have no quarrel, but that they do file a plea that these commissions be composed of men of character and of ability who have accomplished something in the world—men who, while fair and upright, are conversant with the business they are controlling. It is believed that the cry of the corporations for a fair hearing, a recognition of the benefits they have conferred and relief from the hardships and frauds which in many cases they have suffered at the hands of politicians will follow the institution of properly constituted public service commissions, appointed for "good behavior," composed of high-class men, suitably paid and operating under broad and liberal laws.

Mr. Byllesby said he desired to call the attention of the members of the American Institute of Electrical Engineers to the painful fact that it is extremely rare for a professional engineer or constructor in any branch of industry or construction to estimate the cost of construction with accuracy, and that the practically uniform experience has been that all such estimates have proved woefully less than the cost of the completed project. There has not, he said, been a considerable piece of public-service construction in recent years of which the finished cost has not overrun the estimated cost, ranging from a minimum of 10 per cent to a maximum of 100 per cent or more. The professional engineer should be fair-minded and liberal in appraising the value of the property of another man or of a corporation, when upon such appraisal is to be based the return to be allowed. The tendency of the times, at best, is to allow a public-service corporation, after its operating expenses and depreciation charges, a distributable sum equivalent to from 7 per cent to possibly 10 per cent upon its reproduction value; it therefore becomes evident how grievous a hardship may be worked if an appraisal is much below the real value of the property. Possibly 90 per cent of the activities of the electrical engineering profession have resulted from the development of public-service corporations, and if these corporations, through under-appraisals or drastic regulations, are discouraged, this will be immediately reflected in a lessening demand for the services of electrical engineers. The electrical engineering profession could not exist if capital withdrew its support from enterprises requiring their services. The professional engineer cannot get along without the services of capital. Capital should treat the public, the laboring man and the professional man with fairness and liberality; on the other hand, the professional man, who carries a large influence in the community in which he operates, must not forget that close correlation is necessary between brains and capital, nor allow himself, through professional indifference or jealousy, to give capital an unfair hearing or an unjust decision.

Beyond the naked physical value of a property there is required a very large sum to make it an earning entity, and engineers are asked to give the fullest consideration to the question of intangible values. These values embrace interest, accidents and insurance during construction, engineering and supervision charges, the large sums expended in developing a business, in educating the public and in producing a market for the commodity. Other proper charges are the legal expenses of organization and those

necessary to put the enterprise on its feet, discounts on securities sold, the brokerage paid for finding the capital and the large sums spent by the older companies in the period of experimenting to obtain the best apparatus, systems and methods adapted to their requirements. Due regard should also be given to the added cost of piecemeal construction, and losses should be included due to obsolescence and the discarding of machinery long before its life has been exhausted.

A recent example of an appraisal was cited, being the case of a property which in the past had placed a part of its system underground before the streets were paved. In making the appraisal it was ruled that the company was not entitled as a part of its value to the cost it would have been put to had it placed this work under the paved streets, notwithstanding that the company was allowed the cost of the paving incident to that part of its distribution placed underground after the streets were paved. Because the company did part of the work in advance it was not allowed this value, thereby discouraging enterprise. It is pointed out that with the tendency of governing bodies to make a decision such as that just referred to it becomes extremely important for an engineer intrusted with an appraisal to be sure that he gives to the property under consideration the benefit of the full value that he believes it is entitled to, both physical and intangible. In conclusion, Mr. Byllesby referred to the unusual opportunities possessed by members of the American Institute of Electrical Engineers for forming a basis for a proper measure of the questions of value, which questions should be approached with high intelligence, with a professional sense of responsibilities involved, and with an appreciation of the fact that in the combination of capital, the public and professional engineering no hardship can be worked upon any one of the three without inevitably producing its full quota of disaster to the other two.

DEPRECIATION OF ELECTRICAL PROPERTIES.

Mr. Henry Floy presented a paper entitled "Depreciation as Related to Electrical Properties," in which attention was called to the confusion and non-uniformity in the terminology employed in discussing depreciation and the various methods which have been used for estimating the depreciation. He gave detailed definitions of the words depreciation, physical value, development expenses, intangible or overhead values, original cost, cost of reproduction, scrap value, wearing value, service value, present value, going value, good will and franchises. He discussed depreciation under the heads of wear and tear, decrepitude, inadequacy, obsolescence and deferred maintenance. A considerable portion of the paper was devoted to the discussion of absolute and theoretical depreciation, depreciation accounts or reserve funds and of the application of depreciation.

The author called attention to the fact that the rate of depreciation adopted in estimating and providing for accruing depreciation should not be confused with the total sum of depreciation in physical property. Theoretical depreciation must be assumed and provided for as a part of operating expenses if the capital is to remain unimpaired and rates are such as to give the maximum service at the minimum expense. Service value determined from the consideration of the absolute depreciation of physical property should be used in connection with certain proper non-physical values, such as development expenses, going values, franchises, etc., as the basis on which rates should be fixed, capitalization allowed and taxes assessed. Development expenses bear no fixed relation to the cost of the physical property, as their amortization has no necessary relation to the rate of depreciation of the physical property. The author concluded that there exists an urgent demand for co-operation among engineers, manufacturers and service corporations for an intelligent collection and correlation of data on which properly to base estimates on depreciation.

Discussion.

In opening the discussion of the general subject of appraisals and depreciation, Mr. Bion J. Arnold, of Chicago, said that the engineer can perform no higher service to his community than to enter into and explain public-utility corporation relations with the public. In the past, he admitted, perhaps the error has been made by corporations in not viewing the public's side, and from this sentiment swung over until the corporations themselves suffered from public opinion; but the popular verdict is now returning to the point where the public is desirous of treating corporations with fairness and honesty. After mature reflection Mr. Arnold said he is convinced that a public-service corporation is entitled not only to a fair return or interest value on the investment in its properties, but more than this. In cases where stockholders have invested their money during time of stress and financial hazard, the company should be given the right to earn either temporarily excessive profits or good profits for a longer time.

Public-service commissions, in fixing rates, should consider this right of the corporation to recoup its former losses, which should remain in the capitalization until earned. This was the method, said Mr. Arnold, used in the recent physical valuation of the Chicago properties. In arriving at valuations, he added, there should be included not only the cost of reproducing the physical property, but also development costs, interest during investment, engineering costs, promoters' fees, contractors' fees, etc., all of which latter will amount to from 10 per cent to 25 per cent above the mere reproduction value. Mr. Arnold maintained that rates should be based upon the cost of reproducing the property new, or upon its depreciated value plus the money required to put it in first-class condition, declaring as short-sighted the policy of fixing the rates on the present depreciated value alone.

Mr. W. F. Wells, of Brooklyn, urged that only absolute and not theoretical depreciation be considered, pointing out that where the property is in a first-class condition its value should not be depreciated for purposes of rate-making. The company, he said, is entitled to increment values in such cases as, for instance, where a subway is covered by new pavement. Mr. Wells also outlined the work of taking a complete inventory of the Brooklyn Edison Company's underground plant, using Hollerith tabulating machines.

Mr. J. W. Lieb, Jr., of New York, referred to the difficulty of dealing with appraisal cases through the means of legal assistance, and urged that electrical men become better informed on these matters, enabling them to discuss at first hand these important aspects of their business. Mr. Lieb pointed out that tables of depreciation usually do not include obsolescence, which forms an important factor in arriving at the actual value of much electrical equipment in this day of rapid changes in the art. Mr. Lieb also spoke of the necessity for scrapping large quantities of apparatus for which securities are issued and which represent bona fide stock necessary to the development of the business, although not represented in the existing physical value of the plant.

Dr. S. S. Wheeler, of Ampere, N. J., declared his opinion that a definite value on apparatus might be obtained at any and all times, urging that all kinds of depreciation be unified and that as a simplification of the problem only one kind be considered. Mr. Emil Leonarz, of Mexico City, pointed out that, though commissions often decrease the rates, such rates are not proportionately raised when lines are extended into new territories of low income production, removing from part of the capital invested its proper rate of return. Prof. A. H. Ford, of the University of Iowa, proposed that, instead of commissions fixing a definite rate of income for corporations, such earning should be marked by upper and lower limits, falling below which the rates might be increased and above which rates might be decreased. This, Professor Ford declared, would assist in maintaining the equilibrium between company earnings and investments.

LOADING OF TELEPHONE CIRCUITS.

Mr. Bancroft Gherardi, of the American Telephone & Telegraph Company, presented a paper in which were described the results obtained by using distributed inductance to improve the transmission efficiency of telephone circuits according to the Pupin system. At the present time very general use is made of two systems for loading telephone cables, one of which is characterized as medium loading and the other as heavy loading. The heavy loading employs about 0.2 henry per mile, and the spacing between coils is about 1¼ miles. The medium loading provides 0.1 henry per mile, with coil spacings of 1¾ miles. In a few cases a third style, known as light loading, is employed. Light loading employs 0.05 henry per mile, with spacings of about 2½ miles.

The results from the loading of underground cables have been highly satisfactory, and noteworthy improvements have also been obtained from the loading of open-air circuits. The general plan of loading open-air circuits is similar to that used on underground cable lines. The relay coils are built so that they will withstand a breakdown test of 8000 volts.

The outside diameter of the coil is about 10 in., and the resistance of the two windings to direct current is 2½ ohms, while an alternating current of a frequency of 800 cycles per second takes 6½ ohms. One of the very valuable results which have followed from the loading of open-wire lines has been a very substantial extension to the distance over which telephonic service can be given. Without loading 1000 miles represented the greatest distance of telephonic transmission over No. 8 B.W.G. wire. By the loading of a No. 8 circuit the distance has been extended to 2000 miles.

The author stated that in the United States there are at present about 85,000 miles of loaded open-wire circuits and over 170,000 miles of loaded underground circuits. To load these circuits there have been employed about 125,000 loading coils. The day-by-day experience with this enormous loaded line plant has fully demonstrated the success of the undertaking.

Discussion.

Mr. E. H. Bangs, of Indianapolis, in opening the discussion, remarked that it has taken ten or fifteen years of earnest work to perfect the details of loading telephone circuits. The problem is quite similar to the same conditions met with in heavy power transmission, only, of course, in minute form. Dr. F. B. Jewett, of New York, said that the actual attenuation results on loaded lines check up very closely with computations made in advance. The same is true of dielectric dissipation. It is to be remembered that loading means a higher degree of line maintenance than on unloaded circuits. Circuits of various characteristics, loaded and unloaded, must be connected by suitable terminal apparatus to secure flexibility.

Mr. E. H. Colpitts, of New York, commented on the difficulties encountered in introducing the loading coils and also on the refinements of electrical measurement made necessary by this improvement. First of all, high-frequency generators had to be designed, giving frequencies of 200 to 3000 cycles, with outputs of almost pure sine waves. Methods of measuring losses in iron had to be devised, as well as losses in dielectrics, and it was necessary also to measure very accurately the inductance and effective resistance of the loading coils, as well as the bridged impedance on loaded circuits and very small capacities.

Mr. E. B. Craft, of New York, described in an interesting manner the actual construction of inductance coils for loading. He spoke of enameled insulation for the wires in the coils of only 0.0005-in. thickness. Automatic machines have been devised for applying the windings. An ordinary containing case for cable circuits holds twenty-one coils and weighs about 2000 lb. It is placed in a manhole.

Allard Smith, of Chicago, described the system of loading used in that city, and Mr. J. G. Wray, of the same city, said that in Chicago it would be impossible to carry on telephonic conversations commercially without the use of loading coils, inasmuch as overhead wires are not permissible. The loading coil is generally considered as particularly adapted for long lines, but it is also of the highest importance in large cities, with their underground circuits.

Central Station
Management, Policies and Commercial Methods

FREE ELECTRIC-FAN SERVICE FOR INVALIDS.

Electric fans are a great boon to the sick in warm weather, but poor people may not be able to afford to pay for them and the necessary electric service, even though the cost is small. Those who were in attendance at the recent convention of the N. E. L. A. in New York City will remember that in the discussion on residence business Mr. R. M. Searle, of the Rochester Railway & Light Company, elicited some applause when he stated that his company some time ago notified every physician in Rochester that it would at his request supply any invalid with an electric fan, run the necessary service and supply the energy without expense whatever to the patient during the period of his sickness.

Messrs. H. M. Byllesby & Company, of Chicago, also are inaugurating free electric-fan service to invalids by all the electric-service companies they control in a number of States. All invalids who can be reached from the present distribution system are to be furnished free fan service this summer on the certificate of a physician that the fan will be beneficial and that the patient is financially unable to pay for the service. If necessary, service wires will be installed, with the necessary interior wiring; the fan will be loaned and the electricity supplied gratis. Letters will be sent to physicians informing them that the company desires to give free fan service to invalids unable to pay and asking them to certify in writing the desired facts, also notifying the company when the necessity for service has ceased.

Whether or not this is a good stroke of business enterprise, it is certainly a worthy charity, for which the Byllesby interests are to be heartily commended.

EMPLOYEES' HANDBOOK.

A comprehensive "Employees' Handbook" has been issued by the Commonwealth Edison Company of Chicago. Its purpose is to acquaint the 3000 employees with the company's policies and to enable them to adapt themselves to the spirit of the organization. The ideal of the company is expressed as "courtesy to the public and the best possible service." It is shown how this ideal is approached. The policy of the company toward its employees is explained, and the employees' savings fund, merit system, the company library, public library station, Commonwealth Edison Section of the N. E. L. A., night-school scholarships, rewards for suggestions and other aspects of that policy are dealt with at some length. The book also includes general information about the company, including the rates charged for electricity and a list of other handbooks issued by the company. These other handbooks relate to (1) the general

characteristics of the company's service, (2) electric vehicles, (3) wiring regulations, (4) the proper use of the telephone and (5) an emergency directory more particularly for the use of employees in the operating departments. The "Employees' Handbook" makes a pamphlet of twenty-nine pages, and it is written in the earnest, enlightened spirit which characterizes the best electric-service practice of the day.

ECONOMICAL ELECTRIC-TRUCK SERVICE AT BOSTON.

Short-haul trucking service has always been an extremely difficult field for the electric vehicle, but records secured recently at Boston indicate that electricity is capable of driving the horse from this stronghold. The trucking house of Lewis Flanders & Company recently installed a 5-ton truck equipped with two motors mounted in two forward couple-gear wheels, the large rear wheels of the outfit being steel-tired and without motors. The truck makes 25 miles per day and operates at a speed of 5.5 miles per hour loaded

Electric Truck.

and 7 miles per hour empty. The results of the first 1000 miles' operation show that the total cost per day is only $7, the items being: Operator's wages, $2.50; energy, at 3 cents per kw-hour, $1; tires, 80 cents; battery maintenance, $1.25; repairs, 25 cents; fire and liability insurance, 45 cents, and floor space and superintendence, 75 cents. Experience shows that a standard gasoline motor truck of the above capacity cannot be operated at less than $15 per day, the cost of running two double teams being about $12. In the above 5-ton truck 40 per cent of the weight is carried on the driving tires, which are of solid rubber and duplex. A life of 12,000 miles is guaranteed on the tires. Experience has already shown that the elimination of the rubber tires from the rear wheels, which is the chief source of economy, does not interfere with the proper working of the battery.

STATISTICS OF ELECTRIC STREET LIGHTING IN CHICAGO.

On Dec. 31, 1910, the city of Chicago, as shown by the annual report of City Electrician Carroll, was operating 12,366 arc lamps for street lighting, while it rented 893 arc lamps from the Commonwealth Edison Company. The average number of lamps owned and operated wholly by the city during the year was 12,230. The average "cash cost" of the operation and maintenance of these lamps was $38.16 a lamp per year. This includes labor and materials, superintendence and office charges, but does not include interest, depreciation, lost taxes, water rates, rent of office in the city hall, rental of poles belonging to private companies, nor a portion of the cost of other branches of the city government which do more or less work for the electric-lighting service. If these charges be added, the annual cost of maintaining each lamp is $61.95. This is figuring interest at 4 per cent and allowing for depreciation at the rates reported to the City Council by the Arnold Company in 1908. The contract price for rented arc lamps used for street lighting is $75 a year.

Electrical energy obtained from the water-power development of the Sanitary District is now used for all public street lighting in Chicago. In the year 1910 the city paid the Sanitary District the sum of $142,610 for electricity used for this purpose. An itemized statement of the cash paid out for maintaining each of the public arc lamps shows that the cost of Sanitary District energy was $11.66; lamp trimming, $8.60; repairs to circuits, conduits and posts, $5.31; firemen, engineers and other station labor, $3.19; electrodes, $2.66; repairs to lamps, $2.32. Other items, including repairs to electric plants, superintendence and office expenses, etc., bring the total up to the $38.16 mentioned.

In relation to the recently executed contract with the Sanitary District by which the latter agrees to maintain the city's street-lighting system and install 10,000 lamps in addition, Mr. Carroll in his report said that, judging by the December figures, the saving for the year 1911 will be about $78,000, compared with the previous contract, figuring on the present number of lamps. All money expended by the District in the installation of new lamps and the rebuilding of old equipment will be repaid by the city in yearly instalments covering a period of seven years, beginning in 1912. It is estimated that after the old equipment has been replaced by modern lamps the annual saving from the use of hydroelectric energy instead of steam will be over $100,000, while the new lamps will give more light than the old ones.

UNPRECEDENTED DEMAND FOR FAN MOTORS.

It is an ill wind that blows nobody good, and therefore the recent "spell" of warm weather may be said to have a beneficial side in stimulating the business of makers and sellers of electric fans. In Chicago, where there has been a long-continued period of unusually warm weather, inquiry reveals the fact that all dealers in electric fans have been put to their wits' ends to meet the demands. The principal central-station company was fairly deluged with letters and telephone calls, and was forced to call in all the solicitors of its merchandise sales department to meet the demand for handling fan business alone. It is believed that the sales of fans of this company in 1911 will be about 250 per cent those of an average year. On July 3 this company sold over 350 fans in its retail salesroom alone. Oscillating fans have been greatly in demand, particularly in the 12-in. sizes, and probably 100 per cent more of these fans will be sold this year than last year. There is also a greatly increased demand for 8-in. fans.

One of the Chicago supply companies reports the demand for fans as most remarkable, the season being an unprecedented one. The demand began early and on more than one occasion this company was almost entirely cleaned out. Ordinarily the fan season lasts about six weeks, and is over about July 15. Nearly all fans not sold by that time must be carried over until the succeeding season, and as the average fan represents an investment of about $11, the interest on the money so tied up is considerable. The business is something like that in fireworks, with a short season, but an exceedingly brisk demand while it lasts. During the height of the fan season men engaged in other departments are taken to help out during the rush, and all departments of the business are affected more or less. A jobber must carry at least forty sizes, and the

particular dealer from whom these facts were obtained thinks that possibly there should be larger profits for the sellers, in order to offset the hazards and annoyances of the fierce but peculiar demand.

Another dealer reports that it has been almost impossible to get fans fast enough to keep up with the demand. In many cases shipments have been made by express. Never before has there been so great an outcry for electric fans. It has been particularly difficult to supply the need for alternating-current machines; plenty of direct-current fans were on hand, compared with the demand for that type. It is particularly difficult to supply the requirements for 16-in. oscillating alternating-current fans. The season began this year nearly a month earlier than usual, and very likely will last until Aug. 1, or about three months. The big central-station companies realize the advantage to them of putting out all hot-weather appliances possible, as fans, heating and cooking appliances, in order to help fill up the "valley" in the summer load. The central-station companies in the smaller cities, however, do not seem to realize this fact so keenly, and with some exceptions are not, perhaps, as active as they might be in pushing the fan-motor business.

Manufacturers as well as dealers remark the greatly increased demand this season for the oscillating type of fans, and this appears to be true of all sizes. For office and restaurant use the 16-in. oscillating fan whose powerful breeze seeks out every corner of the room, is in great favor. The number of stationary fans which are being converted to the oscillating type is attested by the large number of orders received for the swinging platforms worked by vanes, air wheels or other mechanical devices which have been ingeniously adapted to fan movements.

Even fan manufacturers and salesmen were taken by surprise at the suddenness and number of the fan orders which they received in June and early July in Chicago. On a number of days orders were filled at the rate of 1000 fans a day by several of the manufacturers in Chicago alone.

Department stores and other retailers of electrical supplies all confirm the general cry that the demand for these comforting appliances has been of unprecedented magnitude.

MUNICIPAL WATER PUMPING BY CENTRAL STATION.

In looking over the field for new business to be sought after most central stations do not give proper consideration to the subject of water-works pumping, said Mr. F. D. Spencer, of Cheboygan, Mich., before the Michigan Electric Association, June 22. Of the many reasons why the subject has not been given the serious effort which it deserves, probably the foremost is that the central station when not municipally operated feels that the time and effort necessary to convince the municipality of the advantages of electric pumping are not worth the prospective business. It is true that, as a rule, said Mr. Spencer, the municipality is a difficult customer to obtain. Political situations must be overcome, as well as, in many cases, a gross lack of knowledge of the true conditions surrounding the operation of the pumping plant by the municipality. The want of confidence in the ability of electric service to operate the pumping machinery without interruption has in the past been a strong objection for the central station to overcome.

The municipality should be shown, however, the saving it can effect through the purchase of energy developed under central-station conditions, as well as the lesser space and lower cost of maintenance of electrical installations.

At the same time the central station gains a long-hour load and one that can generally be kept off the peak hours in the smaller plants. All recognize the importance of improving the load-factors of stations, and a pumping load is very desirable in that it helps to even up the underloaded condition of boilers, engines and dynamos, thus decreasing the coal cost per kw-hour output when the station is operated nearer to the full-load point. Further than this there is the possible great saving in labor offered by the remote control of electric-driven pumping equipment and the use of synchronous motors to improve the power-factor of an alternating-current circuit. "With these conditions assured we should not lose heart at the repeated failures to interest the municipality," said Mr. Spencer, "but keep everlastingly at it until the contract is ours."

In considering the best kind of equipment for electrical pumping, there are two systems to consider: First, the plant pumping directly from a stream, shallow well or reservoir into the main; second, the plant pumping from deep wells to a reservoir and from the reservoir to the mains. In the first instance either the plunger type of pump or the centrifugal pump will give satisfactory service when driven by motors. When considering both repairs and efficiency there is practically no choice between the centrifugal and triplex pumps. The efficiency of the triplex pump ranges from 55 per cent to 75 per cent and that of the centrifugal pump from 50 per cent to 70 per cent. In the second place, when pumping from deep wells of moderate depth, the very small plant with limited finances and a limited service may use a plunger type of pump satisfactorily. When considerable quantities of water are pumped or the lift is high the reciprocating deep-well pump is usually troublesome and repair bills are high. In general, however, where the small plant can make use of it, the deep-well centrifugal pump will give the best service. This pump is of the vertical-shaft type and is sunk deep in the well below water level. Where the quantity of water to be pumped is from 250 gal. to 1000 gal. per minute this type of installation is probably the most satisfactory known. The efficiency of this type of pump is from 50 per cent to 60 per cent.

While the air lift is not very economical, it proves to be very satisfactory in many systems. In operations the air-lift pump compresses air which is discharged from a small pipe into a larger pipe sunk below water level. The air thus forces the water to the surface reservoir. The efficiency of the air lift may be anywhere from 20 per cent to 50 per cent, depending on installation conditions. The depth to which the air pipe is submerged and the air pressure necessary have important bearing on the efficiency. The first cost of the air lift is less, however, than the deep-well centrifugal pump, and since it eliminates some of the uncertainty of service and cost of repairs of the latter it may be more desirable for small plants with limited reserve capacity.

Although the cost of pumping naturally varies largely with the conditions under which the water is pumped, Mr. Spencer cited a number of examples giving the figures of electrical consumption for 1000 gal. pumped. One company operating a triplex pump driven by a 35-hp motor and pumping against 100-ft. head reports an average consumption of 700 watt-hours per 1000 gal. pumped. Another company operating a motor-driven deep-well plunger pump reports a consumption of 1333 watt-hours per 1000 gal. pumped against a head of 120 ft. Another plant reports a consumption of 1220 watt-hours per 1000 gal. pumped by a motor-driven deep-well plunger pump lifting 110 ft. One water-works plant in a city of 12,000 inhabitants installed a generator, placing a 7-hp motor at each of nine 65-ft. wells which fed a reservoir. A 100-hp motor driving a triplex pump delivered 1,000,000 gal. of water per day to an elevated tank and the distributing system. As a result the fuel cost was reduced one-half and the number of employees from thirteen to three. A small municipal pumping plant by expending $6,000 in order to change from steam to electric drive claims to have reduced its operating expense $5,000 the first year, energy being purchased on the basis of $26.40 per hp-year.

HOUSE OF EDISON LIGHT AT BOSTON.

The accompanying photographs illustrate the so-called House of Edison Light, which has recently been moved

Fig. 1—Dining-Room of an Electric House.

from Winchester to Newton Center, Mass., by the Edison Electric Illuminating Company of Boston. The house is

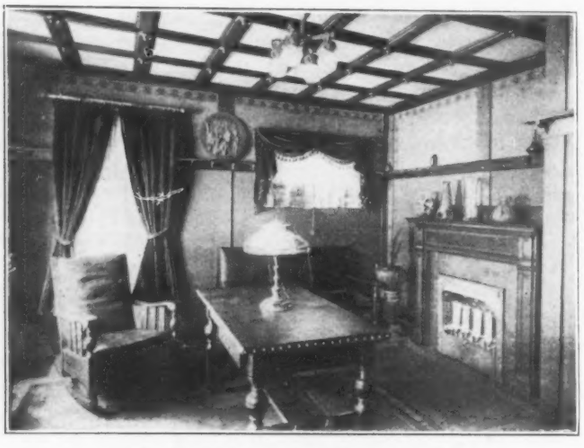


Fig. 2—Library of an Electric House.

equipped with a large number of useful electrical conveniences, including heating, lighting and motor apparatus

Fig. 3—Kitchen of an Electric House.

of tried value in domestic service. It is lighted according to the best canons of modern illumination practice, and has an electric pleasure vehicle and garage attached. The house is of the portable type, and is in charge of a prominent resident of each of the Boston suburbs in which it is located, the duration of the stay being several months in each community. The artistic character of the house and its furnishings has already attracted many thousands of interested visitors, who thus come into close contact with the best electrical applications in residence service.

Wiring and Illumination

FACTORY LIGHTING.

In its report to the National Association of Manufacturers at its annual meeting in New York recently the committee on ventilation, heating and lighting embodied information on factory lighting culled from answers to letters sent to some 3250 firms. The answers in the main make clear that the question of good artificial light has not had very careful consideration from manufacturers in the past, although a number of replies indicate that some of them are keenly alive to the importance of the subject. A few examples of such replies are as follows:

A shoe manufacturer reported that painting walls and ceilings white and keeping them in good condition results in better work being done and keeps the employees better satisfied. A manufacturer of caramels stated that proper lighting is absolutely necessary to get the best results and a large production. One manufacturer reported that he employs a well-known illuminating engineer to solve the lighting problem for him, and another replied to the effect that the actual conditions of artificial lighting in the factory in question are ideal, but nevertheless the output averages 20 per cent less than under daylight. A silk manufacturer stated that it is of great benefit to the work to have well-lighted, well-ventilated and properly heated shops, and that even if these were not necessary on account of the effect on output, he would still have them for the comfort of his employees.

In investigating the question of artificial lighting in factories the first information desired is the degree of importance of the subject, which can be ascertained only by obtaining some idea of the effect of varying light conditions on the product, and it was information of this kind which it was hoped would be obtained from the answers to the questions. It is the belief of the committee that the effect of varying character of artificial light on the quality and quantity of product may be and often is very great and consequently affects the cost of production to a very considerable extent. The committee feels that it is a matter of ordinary observation to those at all expert in the question of artificial lighting that factory lighting, generally speaking, is very far from what it ought to be. The following statement is a brief summary of the principal defects which are ordinarily to be found.

In very many cases there is insufficient illumination. This condition, however, is rapidly improving as the result of the advent of lamps of various kinds of much higher efficiency than anything that has been available in the past. It is a fact, however, that in a great many cases where the absolute amount of illumination is sufficient the light is nevertheless exceedingly unsatisfactory for various reasons. If the light falls on the work from the wrong direction, not only is there great liability that awkward shadows of the machinery or of the operative's body will interfere with the work, but in addition if light is reflected from polished portions of the machinery or from the work itself directly into the eyes of the operative, the results will be anything but satisfactory. Failure of light to come in the right direction is often very distressing to the eyesight and also, in addition, since it may cause the operative to work in an unnatural position, it may result in unnecessary bodily

fatigue as well. Such unfortunate results are often obtained if an attempt is made to light a workroom with too few sources of light. Under these conditions, although some operatives may receive a very satisfactory light, others are extremely likely to get the light in the wrong direction, with the unsatisfactory results above enumerated.

Another very common defect in factory lighting is the exposure of the eyes of the workers to the direct beams of very brilliant lamps. The use of bare incandescent lamps is almost invariably not only inefficient but also dangerous. Generally, however, there is no difficulty in avoiding this trouble if proper care is taken.

It is true, also, that as the result of using the eyes under improper conditions troubles of various kinds, such as headache, nausea, etc., are often induced, although commonly ascribed to some other cause, and these troubles not only reduce the efficiency of the operative while working, but lead to absences which might otherwise be avoided.

Still another defect often seen is either too great or too little contrast in the illumination of rooms. The former of these is by far the most common, and as an example might be given work on sewing machines, where individual lamps with opaque reflectors are supplied which brilliantly illuminate the machines, but leave the rest of the room in comparative darkness. This too great contrast is not only a great strain on the eyes, but has as well a psychologically depressing effect on the workers. On the other hand, the brilliantly lighted room in which the illumination of all surfaces is practically equal to that of the working surfaces is also bad, since the eyes thereby are given no opportunity for rest when raised momentarily from the work.

A great waste of light is often permitted to occur, owing to the failure to keep lamps and equipment clean. The loss of light due to this cause is often as great as 50 per cent. One reply and one only referred to this question and showed that its importance was fully realized. The reply was from a typewriter company, which stated that its incandescent lamps were cleaned and polished once a week.

Mr. William Coale, treasurer of the Sterling Electric Manufacturing Company, Warren, Ohio, is the chairman of the committee.

FOURTH OF JULY CELEBRATION IN NEW YORK.

On July 4, 1866, a great portion of the city of Portland, Maine, was wiped out by a $10,000,000 fire which was started by firecrackers. There is not a city, town or hamlet but what has its list of Fourth of July fatalities. In recent years through the extreme and reckless use of fireworks it has come to such a pass that the fire departments in all American cities are kept on the jump from morning until long after midnight. Medical statistics show a great number of cases treated in clinics or consigned to wards in hospitals as a result of Fourth of July accidents. Then, to top off everything else and to provide a fitting climax for the "glorious Fourth," cities spend thousands of dollars for night fireworks. New York City this year spent $31,000. For half of that sum it is probable that every park in New York could be beautifully illuminated for two nights in the same manner as City Hall Park was lighted with electric lamps in Japanese lanterns. In order to show what could be done along this line and in furtherance of Mayor Gaynor's safe and sane Fourth of July movement the New York Edison Company volunteered to illuminate the City Hall and park, bearing the entire expense. Two bands of 8-cp incandescent lamps encircled the entire building, one at the top and one at the lower ledge. These lamps were colored alternately blue and white, the city colors, and were spaced 1 ft. apart. Garlands of lamps were festooned from tree to tree throughout the City Hall Park, creating a most pleasing garden effect. At night the national emblem and the State and city flags floated from City Hall, while several search-lanterns played on them continuously.

To the thinking observer there was a strikingly obvious contrast between this charming illumination, which lasted the whole evening, and the momentary flashes of

Fig. 1—New York City Hall.

Roman candles and skyrockets, which represented the burning of part of the city's $31,000. Here was a permanent form of beauty which attracted the eye and pleased as

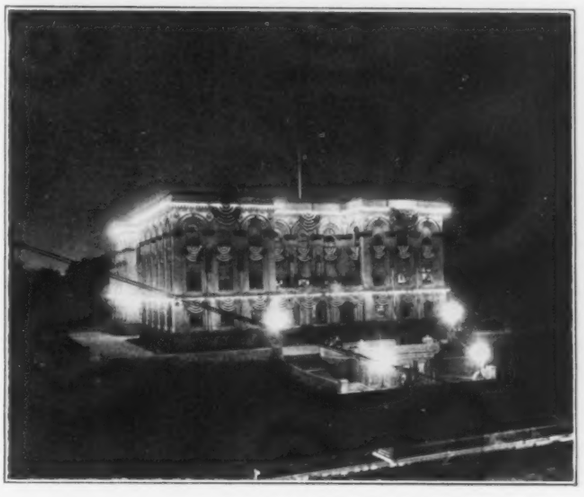


Fig. 2—Bronx Borough Hall.

long as one cared to look at it, while, on the other hand, the costly fireworks were but a transitory gleam of colors in the sky accompanied by a few explosions.

LETTERS TO THE EDITOR.

Globular Lightning.

To the Editor of Electrical World:

SIR:—The reference to "globular lightning" in your issue of June 22 recalls an incident that was brought to my attention several years ago, and which I suspect has some relation to the phenomenon called "globular lightning."

During a severe thunderstorm lightning caused a short-circuit or arc in a chandelier supplied by direct current of 110 volts. At the same instant the occupants of the room were horrified to observe a "ball of fire" burst out of the chandelier and drop to the floor a yard or two distant and

then roll or bound along over the carpet, gradually becoming smaller and finally vanishing before reaching the end of the room, leaving a smell of burning wool. There was no visible damage to the carpet, however. On opposite ends of the room were open windows with the chandelier between and the course of the "ball of fire" was in the direction of the draft of wind through the room.

My explanation was that the arc caused a large amount of metallic gas to be forced out through the opening in a key socket, which, floating down through the current of air, soon condensed or oxidized and disappeared from sight, singeing the carpet slightly in its course.

I have wondered if any "globular lightning" has ever been observed that could not be accounted for in some such way.

Chester, Mass. E. LeRoy Gardner.

Long-Distance Wireless Telegraphy.

To the Editor of Electrical World:

Sir:—In connection with the abstract on page 1592 of your issue for June 22 of a lecture recently delivered by Mr. Marconi in London, it may be of interest to note that in Fessenden's United States Patent No. 706,737, applied for May 29, 1901, and issued Aug. 12, 1902, at page 3, line 48, the applicant states:

"A further advantage incident to the employment of low frequencies is the fact that there is, as I have discovered, less absorption of the electromagnetic force as the waves travel along the ground than when the waves have high frequencies."

Low frequencies (and the necessary accompaniment, long waves) have been used by Fessenden with a distinct realization of their advantages for long-distance work. It is only recently that Marconi has taken up this means of reducing absorption, probably because of Fleming's statement that absorption would increase with wave-length (Fleming's "Principles of Wireless Telegraphy," page 618, 1906 edition only). Marconi was unsuccessful in his attempts at transatlantic telegraphy until he adopted the long waves, when he at once established communication. It is manifestly unfair that Marconi should be credited with the discovery (as in the abstract of the lecture) when it was understood and utilized by Fessenden so very long before.

New York. John L. Hogan, Jr.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Principle of the Static Balancer.—C. C. Hawkins.—A mathematical article dealing with the principle of operation of the auto-transformer used with a double-current generator to obtain the neutral point for a three-wire direct-current system. The alternating emf impressed at the terminals of the transformer coil produces within the coil its normal exciting current. The author shows that it is only approximately correct to treat the actual current in each limb of the balancer as composed of the exciting current and a fixed portion of the out-of-balance neutral-wire current.—Lond. *Electrician*, June 9 and 16.

Static Frequency Changers.—M. Joly.—The author describes static frequency changers for raising the frequency of an alternating current to the double or triple value. The principle of a double-frequency transformer is shown in Fig. 1. Two identical transformers have their primaries

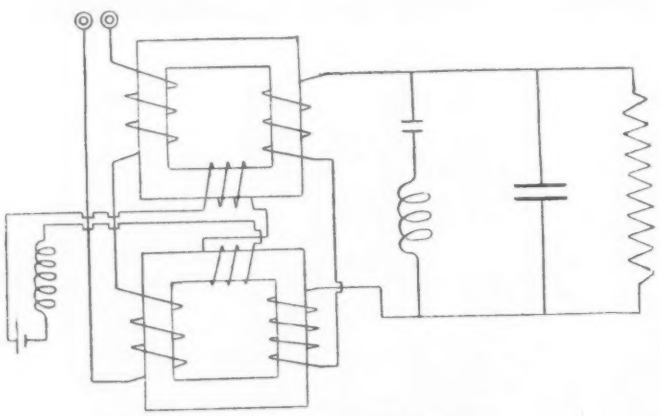


Fig. 1—Static Frequency Changer.

connected in series. The secondaries are also connected in series, but in such a way that the emfs induced in them are opposed to each other. When such a system is supplied with alternating current there will be no energy given out in the secondary as long as no special means are taken to produce in the secondaries emfs of multiple frequency which are not equal and opposed to each other at any instance so as to annihilate each other. The method consists in producing a non-symmetric magnetic field, for instance, by the use of a superposed direct-current magnetization, as shown in the illustration, where each of the two transformers is seen to carry an auxiliary winding, both being connected to a source of direct current. The mathematical theory of the arrangement is given and a triple-frequency transformer is also described.—*La Lumière Elec.*, May 20.

Lamps and Lighting.

Photometric Units.—L. Murphy.—A letter with reference to the recent articles of Trotter and Harrison. The author thinks that, while candle-power is a very useful term for describing the luminous intensity in a definite direction of a light source of small dimensions, it should be reserved entirely for use in this connection. As at present employed it sometimes means intensity and sometimes flux. He thinks that a definition of the shadow effect as suggested by Harrison would be quite difficult, since there are "hard" and "soft" shadows, and, while both help to define the outline of an object and thus, within limits, add to the effectiveness of the illumination, there is no doubt that the former is usually much more objectionable than the latter. The diversity of the illumination on opposite sides of a solid body would give no indication with regard to this most important point.—Lond. *Electrician,* June 9. In his reply to Mr. Murphy Mr. A. P. Trotter maintained that, except for various theoretical considerations, there is nothing unscientific or illogical in using candle-power as the unit of luminous intensity, candle-power per square inch or per square millimeter as the unit of intrinsic brilliancy, and the ft.-candle as the unit of illumination.—Lond. *Electrician,* June 16.

Illumination of the Largest Steamship.—An illustrated article giving a general characterization of the illumination of the steamship *Olympic*, the electrical equipment of which was outlined on page 1593 of our issue dated June 22, 1911. The anonymous writer remarks that "so far as the decorative effect of the illumination is concerned there has been an effort, conscious or otherwise, to produce glitter and sparkle rather than softness and harmony, and this ill accords with the general air of refinement which characterizes the decorations. There is not a room in which the eye

would not be sorely tried by the constant encounter of numerous brilliant points. While electricity has been turned to every possible account in other respects, it has far from realized its possibilities in the way of illumination. In this respect at least there is a golden opportunity for the next in succession of mistresses of the sea to score a complete victory. Let the next largest ship be illuminated in a manner befitting the progress shown in engineering and naval architecture."—*Ill. Eng.* (New York), July.

Arc-Lamp Electrodes of Titanium-Chromium Carbide.—A note on a recent British patent (13,518, June 1, 1911) of the British Thomson-Houston Company (General Electric Company of this country). The object is to increase the life of titanium carbide electrodes by the addition of a small percentage of chromium carbide. An iron tube, closed at the lower end by a plug, contains the mixture. It is found that an addition up to 5 per cent of chromium carbide increases the life of the electrode and also slightly increases the candle-power of the arc, but beyond this, though the life of the electrode is increased, the candle-power slightly decreases. The best results have been obtained with a mixture of 95.5 per cent of titanium carbide and 4.5 per cent of chromium carbide.—Lond. *Elec. Eng'ing*, June 8.

Illumination for Coronation.—An illustrated article on electric-lighting devices installed for the coronation festivities in London.—Lond. *Elec. Rev.*, June 9.

Color in "Blackboards."—A. J. MARSHALL.—A note suggesting that "blackboards" be made from depolished dark-green glass sheets and that the writing thereon be done by yellow crayon. The author expressed the belief that such a combination would be desirable from the psychological, physiological and esthetic viewpoints, being somewhat better than the use of white letters on black background and much preferable to the use of black letters on white background.—*Ill. Eng.* (New York), July.

Generation, Transmission and Distribution.

Increase of Connections of German Central Stations from 1900 to 1909.—G. DETTMAR.—An article giving statistical data on the increase of the connections of German electric central stations from 1900 to 1909. Only those stations were considered which had been in operation for more than two years in 1900. The results are based on a total of 164 stations. A distinction is made between cities of different sizes and a general distinction between cities with and without a gas plant. In order to get comparative figures the connections were calculated per inhabitant. The figures given are average connections in watts per inhabitant.

Number of Inhabitants.	WATTS PER INHABITANT.			
	Without Gas Plant.		With Gas Plant.	
	1900	1909	1900	1909
Up to 1,000	77	121		
1,001 up to 5,000	42	75	28	114
5,001 up to 10,000	33	60	37	82
10,001 up to 20,000	37	52	30	73
20,001 up to 50,000	..	..	21	54
50,001 up to 100,000	..	..	17	43
Above 100,000	..	..	18	66

Some interesting conclusions can be drawn from this table. The rate of increase in the connections during the nine years has been very much higher in cities which had a gas plant than in those which had no gas plant. Moreover, those cities which had no gas plant had in 1900 generally more electrical connections per inhabitant than those cities which had a gas plant. In 1909 the reverse was true. This shows that in cities which have a gas plant it takes more time in the beginning to get connections for the central stations, but later the increase in the connections is very much higher. As a general result it may be said that the existence of gas plants in cities has no detrimental effect on electric central stations. Another interesting conclusion from the table is the relatively higher value of connections per inhabitant in small cities than in large cities. Statistical data were also compiled concerning the change of gas production from 1900 to 1909. In this time the gas mean production per inhabitant increased somewhat (by about 25 per cent) in German cities with 20,000 to 100,000 inhabitants, while in cities with more than 100,000 inhabitants the figure has very slightly decreased.—*Elek. Zeit.*, May 18.

Electricity in Flour Mills.—W. CRAMP AND B. E. STOTT.—An abstract of a paper read before the National Association of British and Irish Millers. The authors consider first what proportion of the total cost of a sack of flour is attributable to the cost of energy, and state the value to be from 4 cents to 12 cents per sack of flour produced. The amount involved is sufficient to justify a careful consideration of the most economical method for supplying the energy needed. Although the choice of the type of power plant depends upon the size and location of the mill and the cost of fuel, yet it so happens that there is always some part of a mill that can better be driven electrically than otherwise. Since electric lighting is almost universally employed, it is necessary merely to provide a larger generating equipment to supply the additional energy for the mill motors. Essential requirements for flour-mill service are reliability and regularity of movement. The best arrangements for a steam-driven mill are not necessarily best for one driven electrically, and there are, besides, differences in detail which must be allowed for. One of the chief of these is the speed of the line shafts. If motors are to be used to their best advantage, belts and ropes should be avoided wherever possible. This involves raising the speed of the roller mill shafts from 200 r.p.m. to about 350 r.p.m., and the centrifugal and purifier shafts may go even faster. All such auxiliaries as hoists, pumps, fans, etc., should be equipped with individual motors, and the main shafts themselves are usually most satisfactory if split up so that one or more motors drive the roller mills and other motors are arranged to drive the purifiers, centrifugals, etc. There is no reason why, by proper electrical connections, the whole of the motors in the mill should not start at one time; and when the miller has his own generating plant they may be arranged to start up all together in absolute synchronism with the engine. Certain general conclusions are drawn from figures given in the paper. Since electricity can rarely be supplied in large quantities at less than 0.6 cent per kw-hour, and in small quantities at less than 1 cent, it seldom enters as a competitor against steam, gas and oil. Turbo-electric drives are of value only for large mills, where, however, they stand pre-eminent. For country mills suction gas and oil are about equal, and when ground space and cleanliness are of importance the Diesel engine is to be preferred. For increasing the power and economy of existing plants the exhaust-steam turbine is often of value, but it will not as a rule justify its inclusion in a new plant. Of electrical systems the three-phase is to be preferred for all purposes—even where only part of the plant is driven electrically.—Lond. *Electrician*, June 16.

Series System in Mines.—DINOIR.—A discussion of the use of the high-tension direct-current series system of Thury in mines, its advantages and limitations.—*Bull. et Compt. Rend. Mens. Soc. de l'Ind. Min.*, March, 1910, page 233; abstracted in *Elek. Zeit.*, May 11, 1911.

Traction.

Protection of Gas and Water Pipes Against Stray Currents from Electric Tramways.—The complete report of the stray-current committee appointed jointly by the German Association of Electrical Engineers, the German Society of Gas and Water Engineers and the German Tramway and Light Railway Society. The report is signed by Messrs. Besig, Buschbaum, W. H. Lindley, Michalke and

Otto. The regulations are accompanied by notes and explanations. The regulations are to be enforced only for direct-current tramways and railways which use the rails as conductors and where the rails are less than 200 m (656 ft.) from a gas pipe or water pipe. The regulations are not to be enforced where the rails are laid insulated on a special track. The rails should form as much as possible a continuous conductor. The resistance of a length of track, including joints, must not be more than 20 per cent higher than the resistance of a continuous rail of the same length, the same cross-section and the same electric resistivity as the rail. The rails of one track, as well as of several tracks near together, must be connected at least at every tenth joint by a cross-connection with a conductor equivalent to a copper wire of 80 sq. mm (0.124 sq. in.) cross-section. Special arrangements must be made at drawbridges, etc. Concerning the voltage drop in the rails a distinction is made between districts in cities in which there is a network with many branches and suburban lines. In the city itself (of course, only as long as there are gas and water pipes at a distance of less than 200 m from points of the rails) the potential difference between any two points of the tramway system must not be more than 2.5 volts. On the suburban lines the voltage drop must not be more than 1 volt per kilometer (1.61 volts per mile). The transition resistance from rails to earth should be as high as possible, but no figure is specified. To increase the transition resistance between rail and earth it is recommended to place the rails in ground of poor conductivity and well dried. The use of salt for melting ice or snow should be limited to cases of absolute necessity. The distance of the rails from the water and gas pipes in proximity should be as great as possible and "if possible at least 1 m (3.3 ft.)." The corrosion of water and gas pipes is considered to depend essentially on the current density at those points where stray currents pass out of the pipes. If this current density is more than 0.75 milliampere per square decimeter (0.0484 milliampere per square inch) the pipe is considered to be in danger and special precautions of protection should be taken. For potential measurements at regular intervals testing wires should be provided to different points of the network.—*Elek. Zeit.*, May 25.

Installations, Systems and Appliances.

Magnetic Switch Control System.—C. Pirtle.—A paper devoted to the operating characteristics and practical applications of a series-wound magnetic switch which provides automatic current-limit acceleration without the use of separate relays. This switch was described on page 107 of our issue dated July 8.—*Jour. Eng. Soc. of Penn.*, June.

Tariff and Central-Station Finances.—Norberg-Schulz.—An article giving statistical data from central stations in Norway showing that for these stations the receipts of the station per installed kilowatt approach a value of about $25 when the rate charged per kw-hour is more and more reduced.—*Elek. Zeit.*, June 8.

Regulations.—H. Taaks.—A critical discussion of the government regulations for electric lighting and motor service installations in the kingdom of Württemberg in Germany.—*Elek. Zeit.*, May 18.

Use of Electricity in Medicine.—S. Turchini.—A review of the present situation of the use of static and galvanic electricity in medicine.—*La Lumière Elec.*, May 27.

Wires, Wiring and Conduits.

Aerial Conducting Structures.—A note on a recent British patent (2242, June 8, 1911) of H. Lange. As a substitute for metal wires for aerial conducting structures use is made of metal ribbons. Formerly marginal radiation was prevented at the expense of increasing the solidity of the structure, by shaping it with beaded edges and inserting wires or cords, which need not be very thick to be sufficiently solid, and yet the thicker the wire the better the radiation. In this invention the inserted material is made of hemp or cotton, which is a favorable form to prevent radiation and at the same time gives sufficient solidity. The metal ribbon may be bent round one or more ropes made of the above material, and the thickness can be chosen such that the ribbons bent round them in no place show small radii of curvature without increasing the weight as in the case of the inserted metal. This method gives a greater flexibility to the structure.—Lond. *Elec. Eng'ing*, June 15.

Impregnated Poles.—F. Moll.—A review of results obtained in recent years with different methods for impregnating wooden poles. The author thinks that the old methods of creosote impregnation and of impregnation with corrosive sublimate are the best and will hardly be replaced soon by others.—*Elek. Zeit.*, May 25.

Electrophysics and Magnetism.

Spark Voltage of Alternating Currents.—W. Wicker.—A long paper giving the results of experiments with numerous diagrams. As is the case with direct current and low voltages, so with alternating current and high voltages, sparks may occur not only initially when there is the first visible discharge, but also when one form of discharge passes over into another form. With alternating current this latter case is especially fulfilled when the limit of the brush discharge is reached. These two kinds of formation of sparks are entirely different in the manner in which they depend on the form of the electrodes, on atmospheric conditions, on humidity, on frequency, etc.—*Elek. Zeit.*, May 4 and 11.

Number of Electrons in the Atom.—H. A. Wilson.—From theoretical considerations the author concludes that the number of electrons per atom is eight times the atomic weight.—*Phil. Mag.*, June.

Electrons.—W. F. G. Swann.—A highly theoretical note on the longitudinal and transverse mass of an electron.—*Phil. Mag.*, June.

Electrochemistry and Batteries.

Conductivity of Acids.—E. P. Wightman and Harry C. Jones.—A report of an experimental investigation of the conductivity and dissociation of organic acids in aqueous solution between zero and 35 deg. The authors found that the temperature coefficients of conductivity, expressed in conductivity units, increase rapidly with dilution and decrease rapidly with rise in temperature for weak organic acids—when not hydrated. When the acids are hydrated the temperature coefficients of conductivity are larger and their increase with dilution and decrease with rise in temperature both take place at a slower rate. Organic acids with the largest constants also have the largest temperature coefficients of conductivity expressed in conductivity units.—*Amer. Chem. Jour.*, July.

Electrometallurgy in Norway and Sweden.—Jos. W. Richards.—An illustrated paper describing the electrometallurgical revolution in the iron and steel industry of Norway and Sweden. Claiming that the conditions of Canada are very similar to those of Norway and Sweden the author predicted interesting electrometallurgical developments in Canada in the near future.—*Proc.* Eng. Soc. Western Penn., May.

Units, Measurements and Instruments.

Frequency Meter.—H. Abraham.—A description of a new frequency meter the principle of which is shown in Fig. 2. The electromagnet 1 is connected in series with a resistor of small resistance 2 across the terminals *PP'* of the network, the frequency of which is to be determined. A second circuit connected to *PP'* consists of a resistor of high resistance 3 and a small mutual-inductance coil 4 5 without iron. On account of the high self-induction of the electromagnet the current in the first circuit (in 1) is in time-quadrature with the emf of the network, while the current in the second circuit (in 3) is in time-phase with this emf. The moving coil 6 is in series with the resistor 2 of the first circuit and the secondary 5 of the mutual inductance coil in the second circuit. The emfs in 2 and 5 would tend each to produce rotations of the moving coil

in opposite directions, but they oppose each other and the instrument is so adjusted that the moving coil remains at rest (the needle being on zero) for the normal value of the frequency. When the frequency of the network varies the emfs no longer compensate each other, since one decreases and the other increases. The equilibrium is thereby disturbed and the moving coil is deflected in one or the other direction according to whether the frequency increases or decreases.—*Bull. de la Soc. Internat. des Elec.*, March; abstracted in *La Lumière Elec.*, May 13.

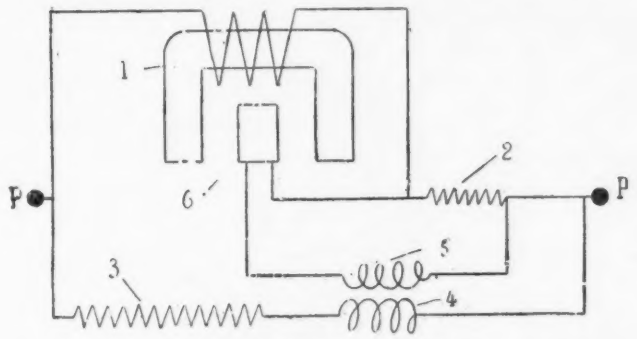


Fig. 2—Frequency Meter.

Energy Measurement in High-Tension Arcs.—J. ZENNECK.—If the energy consumed in high-tension arcs (such as are used in connection with the method of fixation of atmospheric nitrogen developed by the Badische Company) is determined by means of measuring transformers, serious errors may occur even with precision instruments. The cause is to be found in the electrical properties of the alternating-current arc. In the present paper the author shows that it is the direct-current component of the arc voltage which is at the bottom of the errors of measurement.—*Phys. Zeit.*, May 1.

Exhibit of Apparatus.—J. REYVAL.—The conclusion of his illustrated report on the recent exhibition of instruments and apparatus of the French Physical Society in Paris.—*La Lumière Elec.*, May 13.

Single-Phase Induction Meter.—A long and fully illustrated description of a new single-phase induction meter of the Allgemeine Elektricitäts Gesellschaft.—*La Lumière Elec.*, May 13.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—G. MARCONI.—An illustrated account of a lecture delivered at the Royal Institution, London, and noted on page 1592 of our issue dated June 22, 1911.—Lond. *Elec. Review*, June 16 and 23.

Electric Transmission of Signals on Board Ship.—F. SUECHTING.—An illustrated description of a new alternating-current system of transmitting signals on board ship. The principle is that the transmitter produces a phase difference and the indication of the receiver depends on this difference. Two different types of transmitters are described and the details of the system are given with many illustrations.—*Elek. Zeit.*, May 25 and June 1.

Wireless Telegraphy.—E. BELLINI AND A. TOSI.—An article on the use of their wireless telegraph system for communicating between coasts and ships at times of fog. It is possible either to place the dirigible telegraph instruments at the coast and the ordinary receiver on the ship or to use the reverse arrangement. In case the ships are provided with dirigible receiving systems the authors use their "compas azimutal hertzian."—*La Lumière Elec.*, May 27.

Miscellaneous.

Electric Dust Figures.—J. ROBINSON.—The author shows that the formation of electric dust figures can be explained by Koenig's theory that they are due to sound waves emitted by the electric spark.—*Phys. Zeit.*, June 1.

Rules for Firemen.—Rules in force in Saxony, Germany, for firemen when fighting fires in the proximity of electric installations.—*Elek. Zeit.*, June 1.

Austria and Hungary.—Statistical tables on the imports and exports of electrical apparatus into and from Austria and Hungary in 1910. Both imports and exports have increased.—*Elek. Zeit.*, June 1.

BOOK REVIEWS.

THE SEVEN FOLLIES OF SCIENCE. By John Fin. Second edition. New York: D. Van Nostrand Company. 231 pages, 34 illus. Price, $1.25.

The first edition of this popularly written work on paradoxes and scientific "follies" appeared in 1906. The present edition contains fifty-six pages of new matter in which are briefly treated such subjects as: That most great discoveries are made by accident; that lightning never strikes twice in the same place; that powdered glass is a poison, etc. The last six pages are devoted to words which convey erroneous ideas, such as galvanic battery, sparrowgrass, Jerusalem artichoke, etc.

* * *

ELEKTROMOTOREN, UMFORMER UND ELEKTRISCHE MOTORANTRIEBE. Second edition. By Dr. Niethammer. Leipzig: S. Hirzel. 469 pages, 604 illus., including twenty-five plates. Price, 20 marks.

The present is Vol. IX of a series entitled "Handbuch der Elektrotechnik," and is an elaborate and carefully prepared treatise on electric motors and their applications. The principal divisions of the book are as follows: Direct-current motors; single-phase and polphase motors; converters; selection of motors; motor applications; outline of the utilization of motors in factories.

The work will be of great interest and value to advanced students in motor and converter design, as well as to practising electrical engineers installing motors. The descriptions are clear and the illustrations excellent. Much practical information is offered concerning the applications of motors.

* * *

DYNAMOBAN. By Karl Pichelmayer. Vol. V of "Handbuch der Elektrotechnik." Leipzig: S. Hirzel: 745 pages, 432 illus., including twenty-four plates. Price, 36 marks.

A very extensive and compendious treatise on the construction of dynamo machinery, elaborately prepared and illustrated. Some of the plates of machines might serve as working drawings. The work is divided into thirteen main chapters and numerous subdivisions of the same. The subjects dealt with in these main chapters are as follows: Introduction; materials for construction; fundamental principles; windings; computation of the emf induced in windings; commutation in direct current machines; simple magnetic circuits; complex magnetic circuits; losses and efficiencies; temperature elevations; design of dynamos and transformers; mechanical design and construction of dynamos; descriptions of particular types of dynamos and transformers.

There have been no pains or expense spared in the preparation of this fine treatise on dynamo machinery. The book will be very valuable to advanced students of dynamo design and to constructing engineers.

* * *

PRINCIPLES OF WIRELESS TELEGRAPHY. By George W. Pierce. New York: McGraw-Hill Book Company. 350 pages, 235 illus. Price, $3.

A textbook on wireless telegraphy suitable for college students and specialists. The author presents a very useful treatise containing many of his own experimental researches. Especially full treatment is given to the subjects of crystal rectifiers and wave meters. The descriptions

are definite and clear, the diagrams simple and easily followed. Altogether the book is one of the best treatises on wireless telegraphy which have been published in the English language.

* * *

Beispiele und Übungen aus Elektricitat und Magnetismus. By Prof. Dr. Robert Weber. Leipzig: B. G. Teubner. 330 pages, 69 illus. Price, 5.25 marks.

An excellent book either for the classroom or for the private study of electrical and magnetic principles as employed in electrical engineering. Nearly 900 questions or problems are given in the book on consecutive topics in electricity and magnetism. The solutions of these problems are either worked out directly in the text or they are clearly indicated. The book has a very evident field of usefulness and will be much appreciated by a large number of students of elementary electrotechnics.

* * *

Wireless Telephones. By J. Erskine-Murray. New York: The Norman W. Henley Publishing Company. 68 pages, 17 illus. Price, $1.

An elementary and descriptive little handbook showing how wireless telephones work. The following are the chapter titles: How we hear; historical; the conversion of sound into electric waves; wireless transmission; the production of alternating currents of high frequency; how the electric waves are radiated and received; the receiving instruments; detectors; achievements and expectations; glossary. The treatment is clear and simple, no algebra being used. The book will be of interest to the educated public.

New Apparatus and Appliances

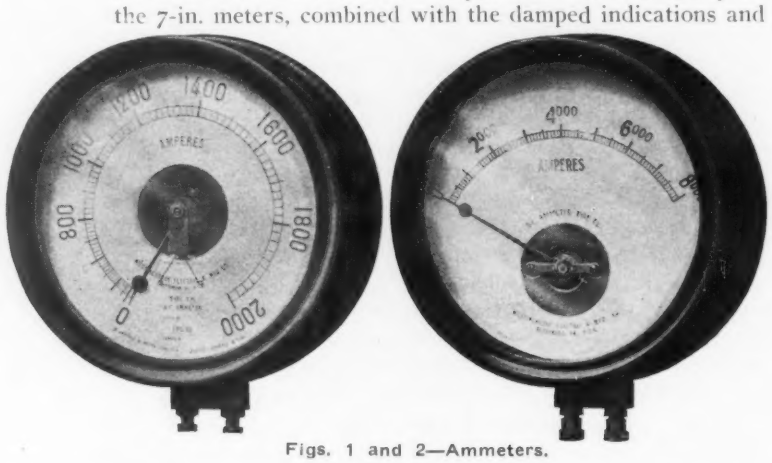
ELECTRIC BOAT PROPELLER.

The electric boat propeller illustrated herewith is detachable and may be applied to high or low boats, boats with straight or slanting sterns, or can be attached to the side of a boat if desired. The device is the invention of Mr. J. E. Haschke, of Chicago, who has had wide experience in storage-battery and electric-launch work. A small motor is mounted vertically, and its armature is attached to the propeller shaft by worm gearing, with a reduction of 1 to 4. It is provided with a steel magnetic frame and is series-wound, with field coils in sections for speed control. No resistance is used in the three-speed controller. A reverse switch on the controller permits reversing the boat. Two portable storage batteries, each consisting of three cells, will operate a three-passenger boat, it is said, at the rate of 5 miles an hour for six hours. For larger boats having carrying capacity for as many as five passengers an extra 6-volt battery is used; or, if it is desired to operate the smaller boat at 6 or 7 miles an hour, the three batteries may be used. The weight of the propeller unit is 35 lb., and each battery weighs about 40 lb.

Electric Boat Propeller.

SWITCHBOARD METERS.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a complete line of 7-in. and 9-in. meters for switchboard use. The alternating-current meters are built as ammeters, voltmeters, wattmeters, power-factor meters, frequency meters and synchroscopes, while the corresponding direct-current meters are built as ammeters and voltmeters. The scales of both sizes of alternating-current meters are 14½ in. long, but this long-scale feature is not depended on alone to make the meters easily readable. Instead of the usual metal front, a flat glass front is used, which makes it possible thoroughly to illuminate the dial from the front without troublesome reflections. The features of compactness and readability of the 7-in. meters, combined with the damped indications and improvements in the electrical design, mark an advance in switchboard meter practice. The 9-in. meters embody the same improvements and meet the demand for a larger meter where economy of space is not a prime consideration. The meters have no moving coils or connections, as they operate on the induction principle. The construction of meters on this principle has a number of inherent advantages. The absence of a moving coil makes the use of flexible or sliding conductors unnecessary and greatly simplifies the construction so that repairs are easily made. The lightness of the moving element makes the likelihood of damage to the pivot jewels remote and reduces jewel wear to a minimum. It is well known that the proximity of heavy busbars affects



Figs. 1 and 2—Ammeters.

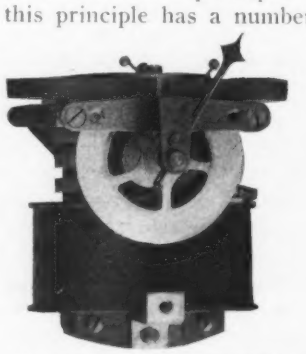


Fig. 3—Ammeter Movement.

Fig. 4—Ammeter-Moving Element.

moving coil and moving iron instruments, even when special internal shields or iron cases are provided. Freedom from the effects of external field, and high torque, are among the advantages gained by utilizing the induction principle. This principle has now come to be recognized as the most practicable principle in the case of alternating-current watt-hour meters, and it is reasonable to assume that the induction indicating instruments will assume the same position for

Fig. 5—Frequency Meter.

switchboard service. A feature of the meters is the damped character of the readings. The pointer does not overshoot, even with full scale variation. This result is obtained by providing a special damping disk moving in the concentrated magnetic field of two permanent magnets. Compared with air dampers this method is asserted to be not only more efficient, but so rugged in construction as to be practically "foolproof." High torque is developed in the meter, and this makes possible the use of a controlling spring of special alloy, tempered and artificially aged to insure permanence under all conditions. Simple zero and calibrating adjustments are provided. Extremes in weight have been avoided in these instruments, and wherever the principle of operation permits the weight has been made as small as possible consistent with substantial and serviceable construction. To this end the movement is made self-balancing to avoid the use of counterweights, the weight of the control spring is carried on the stationary support, all moving parts except the shaft are of aluminum, and the pointer is an aluminum punching of U-cross-section. The fact that the meter element can be removed from the case as a unit allows all parts to be inspected without changing the calibration. The parts can be easily removed and replaced, and the absence of moving coil or flexible connections makes this possible without danger of damage. The previous designs of Westinghouse indication meters have been revised to eliminate the effects of temperature changes, either of the air or of the meters themselves, and inaccuracies due to variations in frequency. The frequency meters, power-factor meters and synchroscopes are of the well-known

Fig. 6—Voltmeter

Fig. 7—Wattmeter.

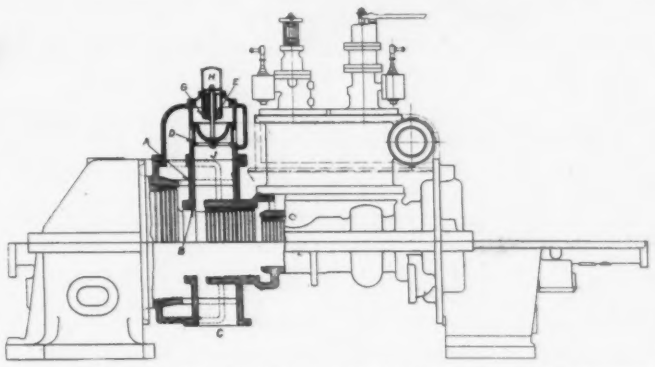
Westinghouse types with the added improvements developed for the rest of these lines.

The direct-current meters supplement the line of alternating-current meters and match them very closely in appearance. They have glass covers, the same types of cases and similar dial appearance, with scales 8 in. long. The meters operate on the D'Arsonval principle, but differ, however, from most meters employing this principle in having only one gap in the magnetic circuit. The moving coil is pivoted at one edge, incloses a circular pole piece, and the other moves through the air gap. With this construction the moving element can be removed and replaced without disturbing the magnetic circuit, and the entire magnetic circuit is magnetized, "aged" and tested as a unit, thus preventing any variation in the strength. The shape of the permanent magnets is such as to shield the meter from external magnetic fields and make it free from the effects of nearby conductors. The moving coil is mounted on a light metal frame, the motion of which in the air gap of the magnets produces a damping effect that makes the readings practically dead-beat. As the coil is pivoted at one edge, its weight counterbalances that of the pointer, resulting in a naturally balanced moving element. This leads to long life of pivot jewels and accuracy of reading. The meters have high full-load torque. The dials of all the meters are hand-calibrated on white cards, thus insuring accurate scales. The divisions are clear and open and the figures large and distinct.

AUTOMATIC BLEEDER TURBINE.

During the recent meeting in Pittsburgh of the National District Heating Association the members of that body visited the works of the Westinghouse Machine Company, where the detail features were exhibited of one of that company's new developments in steam-turbine design, known as the automatic-bleeder turbine.

Its principal advantages result from always using the steam economically before diverting it to the heating sys-



Steam Turbine with Bleeder Connection and Constant-Pressure Valve.

tem and at the same time being capable of automatically supplying large quantities of atmospheric or low-pressure steam for central distribution or industrial applications without affecting its electrical output.

A diagrammatic sectional detail is shown in the accompanying illustration. Generally, the design of the bleeder turbine closely resembles the standard Westinghouse single-flow construction. The division wall *A* is introduced and strip packing provided at *B*, forming a labyrinth with no mechanical contact. Thus the steam leaving the intermediate stage may flow into the heating system through the nozzle *C* or else, with a reduced heating demand, a part of the steam passes through the valve *D* and performs work in the low-pressure section. The automatic valve *D* is controlled by a predetermined pressure in the heating system and the requisite balancing dead weight on the upper side *H*. The piston *E*, inclosed in an oil-filled chamber *G*, is provided to dampen any sudden movement due to pressure fluctuations. Thus if the pressure in the heating system is fixed at 18 lb. absolute and the pressure at the end of the intermediate section tends to rise, due to an increased turbine load, the valve opening will increase, bypassing a greater portion of the steam to the low-pressure stages. On the other hand, if the load decreases and the

pressure at *J* falls, the valve opening will decrease until the pressure is again built up to 18 lb.

A NEW ELECTRIC MOTORCYCLE.

Electric motorcycles seem to offer advantages over gasoline machines like those given by the convenient and pleasant electric automobile as compared with the gasoline car. The operator of the electric motorcycle does not have to run half a block to get the thing started, nor does he sit over a heat-emitting "gatling-gun" engine. Mr. F. E. Hatch, of

Electric Motor Cycle.

85 Horton Avenue, Detroit, Mich., has invented the electric motorcycle illustrated herewith, and he declares that it is a practical machine.

Six cells of storage battery are used to operate the specially designed 12-volt motor, which drives on the rear wheel. The vehicle is said to have a radius of 100 miles per charge on paved streets, and 75 miles over country roads. It is provided with a three-speed controller, by which speeds of 4, 15 and 35 miles an hour may be attained. The weight of the complete outfit is about 200 lb. The battery is mounted low in the frame, and affords a ballast which makes it comparatively easy to learn to ride the machine. The frame is made so that Edison, Exide or any form of standard storage battery may be used.

The seat and the footboard are conveniently arranged, and comfort in motoring is said to be assured to the rider. This motorcycle has a 51-in. wheel base, and the motor is provided with ball bearings and is noiseless. The brake is of the external band type, and the spring fork is cushioned.

FOOT SWITCHES FOR TELEPHONE TRAIN-DISPATCHING CIRCUITS.

On telephone train-dispatching circuits the stations are all connected to the same wires and there may be on such a line any number of telephone sets up to sixty or seventy. For conditions like this, where it is possible for any number of these stations to be listening in upon the circuit simultaneously, and where quite frequently from four to six stations are called in to receive orders, special high-efficiency transmission apparatus is required. The Western Electric Company has solved this problem by the use of a switching device. In the normal position of this switch the most efficient circuit for receiving is obtained, and when the switch is thrown the most efficient circuit for transmitting is cut into service. At many stations it is considered preferable to have the operator work this switch by his foot, rather than to use a key which he must throw with his hand. The advantage of the foot switch is obvious in that it leaves both hands free for other purposes. This foot switch is shown herewith. It consists merely of a cast-iron case in which the switch springs are mounted and from which a lever projects to operate the springs. Another advantage of the foot switch is that it makes for greater speed in the use of the telephone apparatus. For this reason it is largely used in connection with the special types of telephone arms

Foot Switch.

with which an operator does not have to put on any head set nor touch any receiver. These arms were specially designed for use in interlocking towers, where the operator is obliged to get away from the telephone quickly to handle his levers, and these arms, in combination with the foot switching device above described, form a most efficient telephone equipment for train-dispatching service.

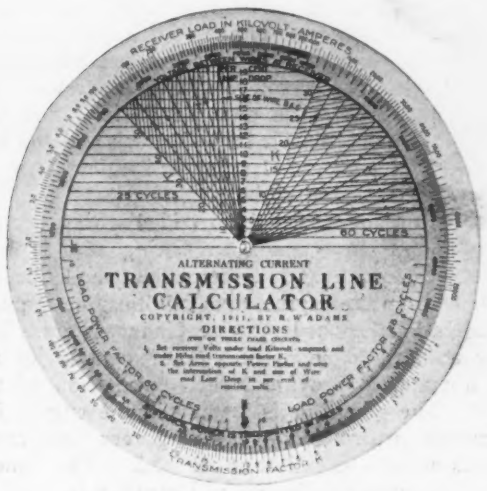
ALTERNATING-CURRENT TRANSMISSION-LINE CALCULATOR.

While the determination of the voltage and energy loss in alternating-current transmission lines and distributing circuits does not present any especial difficulty to the designer who has frequent use for the necessary tables and formulas, there are many operating engineers and superintendents who are responsible for results and recognize the value of accurate methods, but whose knowledge of the technical details involved has been crowded out of mind by broader executive problems. It is in view primarily of the needs of the latter class that there has been devised and is now being placed on the market a simple and reliable device for calculating the line drop and energy loss in alternating-current circuits. This device is called the "Alternating-Current Transmission-Line Calculator," and is made by Mr. Robert W. Adams, 10 Hyde Street, Newton Highland, Mass.

The calculator consists of two disks, a stationary one of opaque white celluloid 4⅛ in. in diameter and a revolving one of transparent celluloid 3 9/16 in. in diameter, eyeleted to the stationary disk so as to turn easily upon it. These disks are printed with the necessary diagrams, the stationary diagram being in red and the revolving diagram in black to permit of easy reading. The printing is done

by a patented process which renders the lines moisture-proof and non-erasible. The ranges of the various scales are as follows: Load, from 10 kw to 20,000 kw; voltage, from 1000 volts to 50,000 volts; power-factor, from 10 per cent to 100 per cent; distance, from 1 mile to 100 miles; conductor, from No. 8 to No. 4-0; line drop, from 0 per cent to 20 per cent; frequency, 25 cycles and 60 cycles.

In operation it is only necessary to make two settings to obtain the result. The value of "K," which is obtained in the first setting, is a transmission factor depending on the load, voltage and distance of transmission, and this factor is used directly in the second setting to determine the line drop, or "regulation," which is defined as the difference in voltage between the two ends of the line expressed in per cent of the receiver voltage. The method of securing the result includes in an accurate manner the effect of load power-factor, which has become increasingly important with the recent remarkable development of motor load, and, furthermore, is easily reversible, a feature which is not possessed by the algebraic methods and one which is of great value where it is desired to obtain the size of wire necessary to produce a given drop.



Transmission-Line Calculator.

Complete directions are printed on the back of the calculator, together with a typical example, by following which a person having no technical training whatever may readily learn the method.

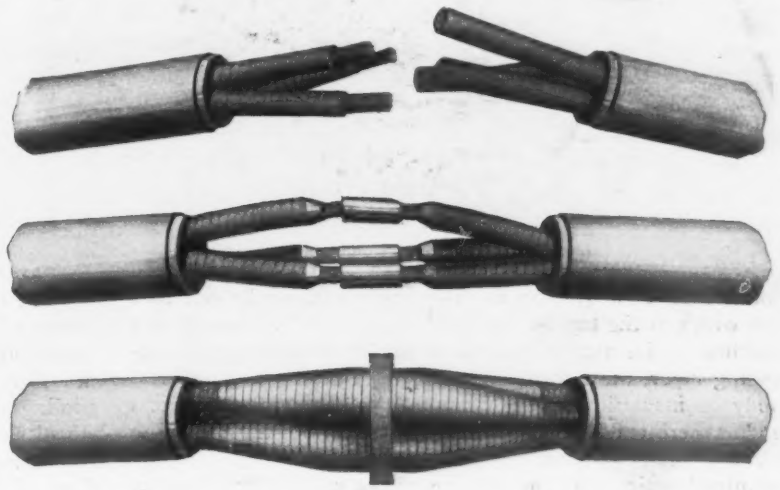
Upon the back of the stationary disk is also printed a convenient reference table giving the weights and costs of bare and triple-braid weatherproof copper wire per mile of two-wire, three-wire and four-wire circuit. This table is new and will prove useful for estimating the cost of proposed lines. Another useful feature is that the two lower revolving scales ordinarily representing distance and transmission factor can also be used as an emergency slide rule for solving problems in multiplication and division. The time required for a person acquainted with the calculator to make a complete determination of line drop is stated to be less than one minute.

The calculator is based on the use of annealed copper wire at 20 deg. C. (68 deg. Fahr.) or hard-drawn copper wire at 15 deg. C. (59 deg. Fahr.), and on three-wire, three-phase, and four-wire, two-phase circuits. Single-phase circuits can be calculated as easily as three-phase, although the device is primarily designed for three-phase circuits as being the most common for transmission work. The diagrams are based on a spacing of 18 in. between wires and are sufficiently correct for all practical work on circuits varying from 6 in. to 48 in. spacing. It is stated that the accuracy of the calculator will compare favorably with similar results obtained by any of the formula or graphic methods, and in all cases will come far within that of the original assumptions of load and power-factor.

MAKING CABLE JOINTS ON UNDERGROUND HIGH-TENSION LINES.

Owing to modern methods it is possible nowadays to use underground potentials in cities which were not considered possible with the materials and methods of construction of a few years ago. The Minerallac Electric Company, of Chicago, has devoted much attention to this important subject, and has produced compounds and tapes which are widely used for this purpose.

First the areas surrounding the cables to be joined should be cleaned and dried as much as possible in order to prevent the introduction of foreign matter. The cables should then be carefully trained and supported in the exact position which they are to occupy after the completion of the joint. In making the joint the materials needed in addition to the necessary tools are linotape in 1½-in. and ¾-in. widths, semi-liquid compound, semi-solid compound, three copper sleeves for connecting the cables and a lead sleeve for covering the joint. The first three are Minerallac company products.



Figs. 1, 2 and 3—Process of Making Cable Joints.

The two ends of the cable are sawed off so that they will butt squarely together. Next the lead sheath is removed for 8 in. from the end of each cable, and the outer cable paper insulation is also removed to within ¾ in. of the remaining lead sheath.

Directions for Jointing.—Cut back the paper insulation on each conductor about 1⅛ in. from the end. Fig. 1 shows the appearance of the severed cable at this juncture. Clean

Fig. 4—Joint Completed.

and tin the copper of the conductors, always using soldering flux for this purpose. Slip the large lead sleeve which is to be used in covering the completed joint over one end of the cable and back far enough so as to be out of the way. Then insert the two ends of each conductor within the copper sleeves which are to be used as connectors and solder them very thoroughly into their separate sleeves by pouring melted solder over the connections. Remove all excess solder, while hot, with care.

Cut the paper insulation of each conductor ⅜ in. farther back from the copper sleeve, in order to remove any material which may have become charred during soldering. Starting 1 in. back from the end of this insulation, taper the paper down to the conductor, as shown in Fig. 2. Then wind the ¾-in. linotape on the section of exposed cable until the diameter is built up to that of the copper sleeve. This wrapping must be applied in such a manner as to fill

the space completely and the semi-liquid Minerallac compound, slightly heated, should be freely applied with a brush between the layers of wrapping in order to exclude the air. Next apply the 1½-in. linotape to the joint, with the compound, as before, the turns overlapping two-thirds of the width of the tape. Continue this wrapping until the insulation around each conductor is built up to a thickness equal to that of the original paper insulation.

Starting at a point on the insulated conductor 3 in. from the lead sleeve on one side of the joint, apply a layer of tape to within 3 in. of the sleeve at the other side of the joint, each turn overlapping the one preceding by one-half the width of the tape. The following layers are started and finished ½ in. nearer the center of the joint than the preceding layer, the completed wrapping forming a cylindrical body of insulation at the center of the joint, with conical ends tapering down to the original paper insulation. The total diameter of this completed cylindrical portion is determined entirely by the voltage of the cable; for example, the diameter of the cylinder should be about 1½ in. for 10,000 volts.

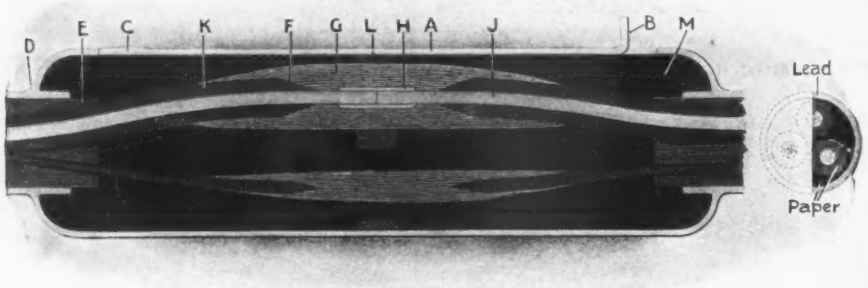


Fig. 5—Section of Cable Joint.

After all three conductors are insulated as described, place a roll of tape ¾ in. in diameter between the conductors to act as a spreader. Finally, wind a narrow wrapping, built up to the inside diameter of the lead sleeve, around all of the conductors, in order to hold them together and also to center them within the sleeve. The joint will then appear as shown in Fig. 3.

Slip the lead sleeve into its proper position and fasten the ends to the two cables by "wiping." This must be done in a workmanlike manner in order to insure a water-tight joint. Make a hole about ¾ in. square on the top of the sleeve near each end by cutting on three sides and bending back the lead on the fourth side as a hinge. Heat a quantity of the semi-solid compound sufficient to fill the joint completely and pour it slowly into one hole until the joint is full. Leave it undisturbed for half an hour, thus allowing the compound to cool and shrink. When cool, carefully level the joint and pour in more hot compound until it flows from both holes, showing that all voids have been filled. Replace the hinges of lead which were bent back to form the holes and seal carefully by soldering. The completed joint will now have the appearance shown in Fig. 4. If the work is properly done this joint will be as strong, mechanically and electrically, as any other portion of the cable.

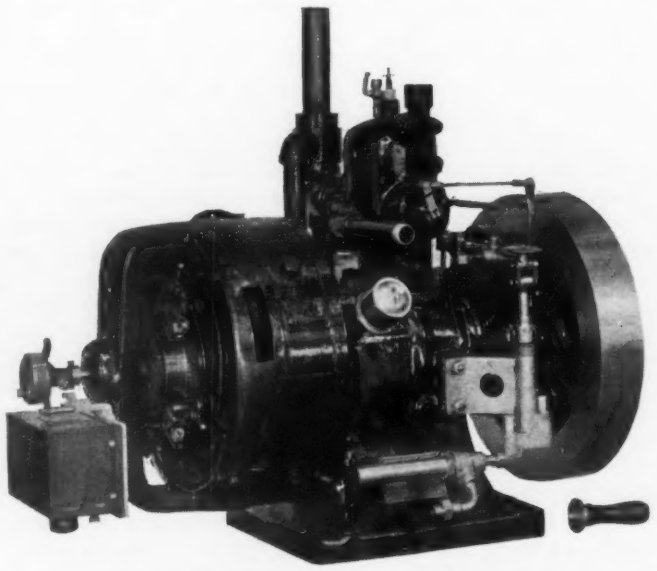
Fig. 5 is a sectional view of a cable joint made in accordance with the foregoing instructions. Referring to the lettering, the various parts are as follows: *A*, lead sleeve which covers completed joint; *B*, opening cut in sleeve through which joint is filled; *C*, opening corresponding to *B*, which has been closed by soldering; *D*, "wiped" joint, connecting the lead sleeve and the sheath of the cable; *E*, paper insulation of cable; *F*, paper insulation of each conductor, showing taper to the copper; *G*, linotape wrapping around each conductor; *H*, copper sleeve connecting ends of conductors; *J*, copper conductor; *K*, paper insulation around conductor; *L*, roll of ¾-in. linotape around all three conductors; *M*, semi-solid compound used to fill completed joint.

ONE-KW GAS-ELECTRIC GENERATING SET.

The General Electric Company, which manufactures gasoline-electric generating sets having ratings of 3 kw, 5 kw, 10 kw and 25 kw, has added to this line a 1-kw set which is designed for furnishing electricity for motors and lighting in private residences, small hotels, rural railroad stations, etc., not now served by central stations, and on board boats. This set comprises a single-cylinder, vertical, two-cycle water-cooled gasoline engine direct-connected to a 1-kw direct-current generator. The regulation and steadiness of the voltage of this set are stated to be so good that it is possible to supply current direct from the generator, thus avoiding the expense of installing and maintaining a large battery and the loss of power and troubles incidental to the operation of the latter.

The engine is provided with a suction gasoline pump for lifting fuel from a tank placed underground and located at some distance from the engine, thus fulfilling the requirements of the National Board of Fire Underwriters. The cooling is by a thermo-siphon, thus doing away with the necessity of a pump to provide forced circulation of the cooling water. The governor is located in the engine flywheel and operates a throttle valve, giving very close regulation and satisfactory operation at all loads. The dimensions of this 1-kw set are as follows: Length, 2 ft. 6⅝ in.; height, 2 ft. 2 in.; width, 17⅝ in.; total weight, 350 lb.

As it is frequently desirable to install a small storage battery to provide lighting on occasions when the generating set is not running, the General Electric Company manufactures for use with these sets a suitable board for controlling both the generating set and such a battery, as well as two types of switchboard for controlling the set alone. The combination generator and battery switchboard is so arranged that the battery can be charged at the same time that the generating set furnishes power for lamps or motors without affecting the operation of these appliances, while when the battery is fully charged it can be connected with the system so that the generating set can be shut down without interrupting the service.



One-kw Gasoline-Electric Generating Set.

Industrial and Commercial News

THE WEEK IN TRADE.

TAKING into consideration the oppressive weather at the important trade centers, and the natural curtailment of operations resulting therefrom, the record of the week has, in general, been satisfactory. Greater improvement is being shown in the steel trade, not only in the affairs of the Steel Corporation, but also in those of many independent concerns. The monthly statement of the former, showing an increase of 247,000 tons as compared with the report of June 1, was regarded as a most favorable indication of progress in business conditions, particularly in view of the period of the year. In addition to the advices from the steel trade, the report of the Department of Agriculture, showing the condition of crops on July 1, was a feature of great interest throughout the country. The report showed, in spite of appreciable damage to wheat, corn and hay, as a result of the prolonged absence of moisture, that both spring and winter wheat will be well up to the average in total production, and that the amount of wheat in bushels will probably show little variation from the average of the last five years. The outlook for crops as a whole, while under the expectations of the early part of the year, is exceedingly hopeful, and is strengthened by news of rain in cotton and corn belts in the early part of the current week. Owing to the uncertain attitude toward crop conditions, affairs in the West are said to be somewhat weakened, with activity on a diminishing scale, as indicated by cancellation of orders in many lines. The business of the country as a whole is showing signs of improvement, and from present indications the transactions of the second half of the year will be in much greater volume and far more satisfactory than those of the first part. Business failures for the week ended July 6, as reported by *Bradstreet's*, were 180, as compared with 227 for last week, 182 in the same week of 1910, 182 in 1909, 246 in 1908 and 185 in 1907.

THE COPPER MARKET.

REDUCTION of 8,561,768 lb. in copper stocks was shown in the report of the Copper Producers' Association for the month ended June 30, and this was also the chief item of interest in the trade during the week. The decrease was in keeping with the expectations of the trade, and the report as a whole was well received. Production was 124,554,232 lb., a decrease of 2,408,232 lb. in the output as compared with May, and domestic deliveries were 61,665,561 lb., being 2,888,402 lb. less than in the preceding month. Export deliveries were somewhat larger than in June, the total being 71,460,519 lb., representing an increase of 9,481,962 lb. While the decrease in stocks is hopeful, the gain in export business is the most important and encouraging part of the report, for without doubt a large portion of the decrease in surplus copper is due to shifting of stocks. Domestic consumers are still out of the market for large amounts, and such improvement as may be made in the month of July will probably be a result of activity abroad. There is a possibility that July production will show a falling off owing to necessity of curtailing operations at the smelters on account of the extremely hot weather, and such reductions, small as they may be, will be a step in the right direction. Although business has been dull throughout the week, prices are well sustained, and 12¾ cents is being asked for electrolytic. The improvement in the steel trade is regarded as a favorable sign for increased activity in the copper trade, and the attitude is far more cheerful than in recent weeks. Exports for the month, including July 11, were 9,735 tons. The daily call on the Metal Exchange July 11 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.12½	12.25	....
July	12.15	12.35	12.25
August	12.17½	12.37½	12.27½
September	12.17½	12.37½	12.27½
October	12.17½	12.37½	12.27½

The London market, July 11, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 3 9	57 5 0
Standard copper, futures	57 15 0	57 16 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

General Electric Sales.—The Terre Haute, Indianapolis & Eastern Traction Company, of Terre Haute, Ind., has placed an order with the General Electric Company for two 300-kw rotary converters, fifteen 100-kva transformers and a switchboard. The rotary converters and six of the transformers will be installed in the Maywood substation. Six of the transformers will be installed in the Mooresville substation and three in the Martinsville substation. The transformers are oil-cooled, 25-cycle units, 33,000 volts primary and 390 volts secondary, and are provided with 50 per cent starting taps on the secondary. The switchboard will be installed in the Maywood substation and will control the 33,000-volt incoming lines, the bank of step-down transformers and the rotary converters. It will consist of an alternating-current, rotary-converter panel, two direct-current, rotary-converter panels, rotary-converter starting panel, and a blank alternating-current, rotary-converter panel. The ammeter for the incoming line is connected directly in the primary circuit, being insulated with post type insulators for this service. A triple-pole, automatic K-10 oil-break switch protects the transformers. The order includes an equipment of 33,000-volt, three-phase aluminum-cell lightning arresters with horn-gap disconnecting switches.

Republic Railways & Light Company to Make Improvements.—It is stated that the management of the Republic Railways & Light Company, which was recently formed to acquire a large number of traction and lighting properties in Ohio, as described in the *Electrical World*, July 1, plans to spend a large sum of money in improving the conditions of the various properties, and in lowering the costs of operation at many of the plants. It is further stated that about $3,000,000 will be expended for this purpose within the next five years. The improvements will include better equipment in the shops at the various traction properties, additions to existing power stations, double tracking on some of the systems, and various means toward reducing the cost of generating energy. The franchises of the company in Pennsylvania are perpetual, while the city franchises in Ohio were recently renewed for twenty-five years; the interurban franchises are said to expire at various times from 1945 to 1950. The largest power station owned by the company is that at Youngstown, which has a capacity of 9,000 kw. The capacity will be increased in the fall by 4,000 kw.

Allied Machinery Company Making Progress.—Captain G. L. Carden, of the Allied Machinery Company of America, which was recently formed to sell American machinery abroad, as described in the *Electrical World*, June 15, has established a branch office for the company in Paris, and will shortly open a branch office in Vienna. Similar offices will be opened in many other European cities, each of which will be managed by an American with such American assistants as are available, and with such local assistants as may be desirable for meeting the needs of customers in the various sections. C. N. Thorn, manager of the home office, 55 Wall Street, New York City, says that inquiries are being received in good volume, and that many quotations have been furnished to date to prospective customers at the Paris office.

Boston Edison Company Contracts.—Among important lighting contracts received recently by the Edison Electric Illuminating Company of Boston is that from the Hotel Thorndike, in Boston, and a street-lighting contract from the town of Chelsea, Mass. The isolated plant which has been in operation in the hotel for a number of years will be dismantled. The contract with the town of Chelsea is for a period of ten years, and the extension of the mains for this service brings the lines of the Edison company close to the New Hampshire boundary.

Pennsylvania Railroad Urges Economy.—With a view to promoting economy in all branches of its affairs, the Pennsylvania Railroad Company has issued a circular to employees on one of its divisions, outlining the necessity for reduction of expenses, and various ways in which money can be saved for the company by careful attention to details. The idea is applicable to many lines of industry other than the railroads. The circular says in part: "Every employee can assist in accomplishing the desired reduction in expenses. As a practical illustration: If everyone of the 1400 employees of this division would save 10 cents a day for the company, it would mean a total saving of $140 per day, or in the month a total of $4,200, which would go toward paying the increased rates of wages which we are now enjoying. How easy it would be for each employee to do this in his own line of work; engine men in the use of oil; firemen in the use of coal; clerks by economy in the use of stationery and by avoiding errors; trackmen in gathering up old bolts and spikes; shopmen by doing their work properly and thus avoiding breakdowns on the road; warehousemen by loading freight so as to avoid damage; and all employees in many ways which will occur to them in the intelligent performance of their respective duties."

Electrical Industry in Switzerland.—In a report to the Bureau of Manufactures the United States Consul-General at Zurich, Switzerland, Mr. Robert E. Mansfield, states that the electrical industry underwent important changes in the past year. The strong competition of the large German electrical works, with greater capital and a wider field of operation, caused the Swiss manufacturers to form combinations with foreign interests, chiefly to enable them to compete with their more powerful rivals. The activity in the industry during the past few years was largely due to the business of installing hydroelectric plants and equipment for street and interurban railways. Electrical development has been general in recent years, and practically every town, hamlet and community in the country is supplied with electric light and power, while all the street railways and many of the interurban and mountain roads are equipped with electricity. But the local trade is no longer sufficient to support the industry, and it is for the purpose of meeting foreign competition and securing international business that combinations with outside concerns have been formed.

Affairs of American Electric Fuse Company and Its Officers.—It is alleged that the liabilities of the American Electric Fuse Company, of Muskegon, Mich., which was declared a bankrupt on June 30, will amount to over $700,000. Frank G. Jones, president of the company, pleaded guilty to the charge of forging a check for $5,482.64, purporting to have been signed by R. Williamson, of Chicago. He was arrested on the complaint of the Old National Bank of Grand Rapids, Mich., and on July 6 was sentenced to imprisonment for an indeterminate sentence of from four to fourteen years, with a recommendation for ten years. Jones insists that the money raised in what appears to be a remarkable series of forgeries was used in the business of the company, and that he did not profit by it. Charles L. Johnson, of Evanston, Ill., former treasurer of the company, was arrested on July 1, charged with complicity in the fraudulent transactions. Jones is said to have involved Johnson in his confession. The ex-treasurer was released on $7,000 bail pending trial.

Triumph Electric Company Sales.—Orders received by the Triumph Electric Company, Cincinnati, Ohio, during the month of June were as follows: Four motor-generator sets, aggregating 325 kw; 162 motors, aggregating approximately 1850 hp; 103 generators of approximately 4160 kw, three 300-kva alternators, and one synchronizing set. These orders were distributed over fourteen States. The company also reports that it has orders for about 200 motors of various sizes in its shops. A number of inquiries have been received in the past month from foreign countries, including several from India, South Africa, New Zealand and South America. The directors of the company have declared a quarterly dividend of 1½ per cent on the preferred stock, payable July 15. This is the twelfth quarterly dividend paid consecutively. Since moving into its new plant eighteen months ago a handsome gain in business has been shown. The first six months of the present year show a gain of 15 per cent over the same period last year.

Vacation with Pay to Factory Employees.—The Holtzer-Cabot Electric Company, through its president, Charles W. Holtzer, announces that it will give to each of its employees who has been in the company's service ten years or more a week's vacation with full pay in the present summer. The announcement was posted in the Brookline and Boston factories last week and goes into effect as soon as arrangements can be made to enable a certain number of men from each department to leave at the same time. The company employs about 500 mechanics, and of these about 150 will profit by the plan. The offer of Mr. Holtzer comes entirely unsolicited and is said to be without precedent in New England. The action is consistent with the company's settled policy of considerate and kindly treatment of its employees.

New Generating Station in Grand Island, Neb.—Work has been started by the Grand Island Electric Company, of Grand Island, Neb., on a new power station which is to replace the present one, with the exception of the boiler house. This will be retained and will be equipped with new boilers. A 500-kw horizontal Curtis turbo-alternator has been purchased and a new switchboard and other equipment will be provided. A 165-ft. reinforced-concrete stack is to be built by the General Concrete Construction Company, of Chicago, and in addition to the new power plant, a new office building will be erected. B. E. Sunny, of Chicago, is president of the Grand Island Electric Company, and Pierce, Richardson & Neiler are the consulting engineers.

Doherty Plants.—On July 11 the Denver Gas & Electric Company, the Denver Steam Heating Company and the Lacombe Electric Light Company were absorbed by the Denver Gas & Electric Light Company. A 300-kw unit has been purchased for the Citizens' Light, Heat & Power Company, Mt. Vernon, Ill., and a 500-hp Stirling boiler has been purchased for the Easton Gas & Electric Company, Easton, Pa. Work is progressing rapidly on the alterations to the fourteenth floor of No. 60 Wall Street, New York City, the whole of which is now being occupied by the Doherty company, as mentioned in a recent issue. Mr. Doherty, who has been for several weeks in England and Norway, returns Aug. 17.

Allis-Chalmers Cincinnati Plant.—The engineering, purchasing and sales departments of the Bullock electric plant at Cincinnati have been reinstated, and E. T. Pardee, of Milwaukee, has been appointed general manager in charge of all departments. E. R. Knight continues as superintendent. Between thirty and forty people will be transferred from Milwaukee, some of whom were taken to Milwaukee four years ago when the Allis-Chalmers Company took over the active operation of the plant. Hereafter all correspondence in regard to sales will be between the Cincinnati office and the sales agencies of the company, instead of through the Milwaukee office.

Standard Underground Cable Company to Build in Canada.—A branch factory, to cost about $500,000, will be built at Hamilton, Canada, by the Standard Underground Cable Company, of Pittsburgh. The buildings will be of the most recent factory construction, and there will be six in the first set. There will be a three-story brick and structural iron building, 64 ft. x 335 ft.; a one-story saw-tooth building, 60 ft. x 224 ft.; a one-story saw-tooth building, 60 ft. x 250 ft.; two one-story buildings, 64 ft. x 90 ft., and one 30 ft. x 70 ft., and an office building. When the plant is completed, about 500 men will be employed.

General Motors Company to Develop Foreign Business.—A company known as the General Motors Export Company has been incorporated in Michigan to take care of the foreign business of the General Motors Company. The officers of the company are: Thomas Neal, president; Gleason Murphy, first vice-president, and C. B. Bennett, vice-president and general manager. The headquarters of the company will be in New York, and agencies will be established as soon as possible in various cities abroad and in the Latin-American countries.

Otis Elevators for Municipal Building of New York.—Contracts for the thirty-three gearless traction-type elevators for the Municipal Office Building of the city of New York, in the course of construction, as described in a recent issue, have been awarded to the Otis Elevator Company. The bid of the Otis company was $582,000. There was only one other concern in the bidding, but since it did not conform to the requirements by sending a deposit with the proposal, its offer was rejected.

Aluminum Notes and Prices.—The aluminum market, as of July 11, is reported quiet, with ingots for remelting held at 21@22½ cents spot No. 1, the base for large ingots. Rods and wire are held at 31 cents, with sheets at 33 cents.

Financial.

THE WEEK IN WALL STREET.

TRANSACTIONS on the New York Stock Exchange continue on the narrow scale of recent weeks, with minor changes following the news of the day. The dullness of the latter part of the previous week, caused by waiting for the government crop report, was broken at the opening on Monday by news of rainfall in the agricultural districts. Some disappointment from the financial standpoint was found in the government figures when received, and stocks reacted from the advances in the earlier part of the day. On Tuesday a slight recovery was made, with the tone of the market strong and the trading largely professional. The strongest issues were those of the roads traversing the crop areas, indicating that adverse crop reports were discounted to a large extent. The bond market has lost some of its activity, and the falling off is attributed to temporary satisfying of the prolonged investment demand. The stock market in the past few weeks has been dominated in the main by crop reports, and to a mild extent by the disturbances in Morocco and political apprehensions. Prices abroad broke sharply upon the dispatching of a German vessel to the seat of trouble, and the heavy selling of international stocks for European accounts assisted in weakening the market. A fair degree of optimism was engendered by the improvements reported in the steel and copper trades, and also by belief that rains in the early part of the week in the agricultural districts will cause better yields than indicated by the government report. Resumption of work in a number of industries following annual shut-downs for inventories and repairs, together with the possibility of an early adjournment of Congress, were regarded as favorable incidents of the early part of the week. The money market shows few changes. Rates July 11 were: Call, 2⅜@2½ per cent; ninety days, 2¾@3 per cent. The quotations in the tables are those of the close July 11.

NEW YORK.

	July 1.	July 11.	Shares Sold.		July 1.	July 11.	Shares Sold.
All. Ch.....	9*	8½	———	Int. Met., pf.	50¼	50¼	3,500
All. Ch., pf..	30	28*	800	Mackay Cos..	89½*	89*	200
Amal. Cop...	69⅝	69½	45,100	Mackay C.,pf.	74⅞*	73⅞*	200
Am. D. T...	20½*	20½	———	Man. Elev...135*		135*	———
Am. Loco....	40¾	41	———	Met. St. Ry..	15*	15*	———
Am. Loco.,pf.	109*	109*	———	N.Y.&N.J.Tel.	139½*	139½	———
Am. Tel. & C.	80*	80*	———	Steel, com...	78⅝	79½	149,500
Am. T. & T.	139⅛	138⅞	9,325	Steel, pfd..	118¼	118⅞	2,050
B. R. T.....	81½	84	18,600	W. U. T....	78⅞	81	1,500
Gen. Elec....	161¼	163	3,525	West'h, com.	76*	76	4,250
Int. Met.....	17⅞	18	1,100	West'h, pfd..	119*	119*	———

PHILADELPHIA.

	July 1.	July 11.		July 1.	July 11.
Am. Rys.....	43¾*	44	Phila. R. T.....	19¼	20¾
El. Co. of A.....	12⅛*	12¼*	Phila. Elec.....	17¼	17⅞
Elec. St. Bt'y.....	53¾	54⅝	Phila. Trac.....	86½*	86¾
Elec. St. Bt'y., pfd..	30*	30*	Union Trac.....	49¼	50

CHICAGO.

	July 1.	July 11.		July 1.	July 11.
Chi. City Ry.....	186*	186*	Chi. Tel. Co.....	124½*	124½*
Chi. Rs., Ser. 1....	87½*	87½*	Met. El. Co.....	27*	27*
Chi. Rs., Ser. 2....	26½	26	Met. El., pfd.....	73½*	74⅞*
Com. Edison.....	130	136	Nat'l Car.....	120*	114*
Chi. Subways.....	4	3⅞	Nat'l Car, pfd.....	118½*	118

BOSTON.

	July 1.	July 11.		July 1.	July 11.
Am. T. & T.....	139⅛	138⅞	Mex. Tel.....	4½*	4½*
Cum. Tel.....	156½*	158*	Mex. Tel., pfd.....	6¼*	7*
Edison E. Ill.....	283	281¼*	N. E. Tel.....	146¼	145
Gen. Elec.....	161½*	163	W. T. & T.....	18½*	20
Mass. E. Ry.....	22¾	23½	W. T. & T., pfd...	96*	96*
Mass. E. Ry., pf....	93½	95			

*Last price quoted.
Shares sold for the week, July 3 to July 8.

FINANCIAL NOTES.

American Power & Light Company.—The directors of the American Power & Light Company, which is controlled by the Electric Bond and Share Company and affiliated interests, have authorized an issue of $2,200,000 ten-year 6 per cent gold notes. The notes will be dated Aug. 1, 1911. Holders of preferred stock and voting trust certificates for common stock as of record July 24 will be allowed to subscribe at par to the extent of 25 per cent of their holdings. The right to subscribe will expire at the close of business on Sept. 1, 1911. The notes will be redeemable as a whole upon any interest day at 102 and interest. Each note is to be accompanied by what is known as an option warrant entitling the holder to receive a certificate for shares of the common stock of an aggregate par value equal to the principal of the note at any time before Aug. 1, 1921, upon the surrender of the option warrant and the delivery of the note, or upon the surrender of the option warrant and payment in cash for the stock at par. The entire amount of notes offered to stockholders has been underwritten by the Electric Bond & Share Company. The notes will be issued to provide partly and temporarily for a floating debt amounting to $3,359,221 and later to increase working capital. This debt was made by purchasing water rights and lands; advances made to the Pacific Power & Light Company; by purchasing $400,000, par value, of the preferred stock of the Kansas Gas & Electric Company and an expenditure to provide for future growth in business. Both the Pacific Power & Light Company and the Kansas Gas & Electric, together with the Portland Gas & Coke Company, are controlled by the American Power & Light Company through the ownership of common stock. The American Power & Light Company has issued to its stockholders a report showing that for the year ended May 31, 1911, the total income was $749,705; expenditures, taxes and interest, $366,495; net earnings, $383,210; subsidiary companies undivided surplus earnings, over dividends paid, accruing to the benefit of American Power & Light Company, $223,896; total net income, $607,106; American Power & Light Company's preferred dividend paid (6 per cent), $168,674; amount transferred to reserves, $50,000; total deductions, $218,674; surplus, $388,432; previous surplus, $238,920; total surplus, $627,352.

Consolidation of Independent Telephone Systems in Northwest.—The State Public Utilities Commission of the State of Washington is reported as making plans for a consolidation of the independent telephone companies operating in Seattle, Tacoma and Spokane. In this connection, Charles M. Fassett, commissioner of public utilities of Spokane, is quoted in part as follows: "The State Commission has already broached the matter to officials of the Bell and Home systems. How the consolidation will be accomplished, if it is in the end, there is no telling, as the proposition is merely tentative so far. Either an actual consolidation of the two companies or a working agreement by which the subscribers on one system can connect with subscribers on the other is the object sought. I understand that Bell officials have already signified their willingness to take over all the Home lines, providing the State Commission can show them a way to do so and still make dividends for their stockholders. Bell officials have said that to take over the Home lines now would mean that a raise in rates on both systems would have to result. The Public Utilities Commission estimates that the dual systems at Seattle are costing the people an unnecessary $1,000,000."

Public Utility Merger in Pennsylvania.—Announcement is made that the West Penn Traction Company has acquired the electric-light and power properties of the Van Horn Ely Syndicate. The transaction includes all the lighting plants in Washington and Greene Counties, together with many charters held by these companies but never utilized. Various companies operating at Edgeworth, Sewickley, Woodlawn, Aliquippa, Ambridge and neighboring localities are included. The West Penn Traction Company is said to have paid some $2,000,000, for which bonds will be issued. New York, Pittsburgh, Baltimore and Philadelphia bankers have formed a syndicate to underwrite these bonds. The acquisition of these properties means an increase of over 100 per cent in the scope of operation of the West Penn company.

Central Hudson Gas & Electric Bonds.—The Public Service Commission for the Second District of New York has authorized the Central Hudson Gas & Electric Company to issue the $1,400,000 5 per cent thirty-year bonds, permission for which was recently applied for as referred to in the issue of July 1. These bonds are to cancel $600,000 bonds of the Poughkeepsie Light, Heat & Power Company, $700,000 bonds of the Newburg Light, Heat & Power Company, and $100,000 bonds of the Hudson Counties Gas & Electric Company. In addition to issuing the foregoing the Central Hudson Gas & Electric Company has been authorized to issue $600,000 bonds for meeting certain obligations of the company, incurred for capital purposes. These are to be issued at not less than 95¼.

Federal Receiver for United Wireless Telegraph Company.—In order to co-ordinate the affairs of the United Wireless Telegraph Company, a federal receiver has been appointed to supersede a number of state receivers who were appointed following conviction of several officers on charges of fraud as was mentioned in a recent issue of the *Electrical World*.

Union Gas & Electric Company.—Accompanying the checks sent out a few days ago for dividends on the preferred stock of the Union Gas & Electric Company was a long letter explaining the financial conditions of the company, its plans for the future and a statement of the business it is doing. Among other things the letter said: "The net earnings for the eleven months ending May 31, 1911, were $282,676.41. The estimated earnings for June, 1911, are $25,000, making a probable total for the year ending June 30, 1911, of $307,676.41. Your company is entirely free from debt and has ample working capital. When it started business on Sept. 1, 1906, there were 51,769 gas consumers. There are now 87,040 gas consumers, an increase of 35,271. In 1906 the company was manufacturing artificial gas, which was sold at an average price of 67 cents per 1000 feet. The company was threatened with competition, and the first aim of your management was to forestall and put your company in an impregnable position. In the electrical department the earnings have shown a steady increase, notwithstanding the introduction of tungsten lamps has materially curtailed the consumption of current. The loss in this direction, however, has been overcome by an extension of the service, so that the net profits have shown a steady increase. We have just entered into an advantageous contract with the city of Cincinnati for a period of ten years. This contract carries with it some valuable rights which are of material benefit to this company."

Public Utility Offerings.—Among investment bonds for July funds offered by Perry, Coffin & Burr are those of a number of public utility companies in various parts of the country. First mortgage 5 per cent gold bonds of the Southern Power Company, due March 1, 1930, are offered at 100, and interest yielding 5 per cent; first mortgage collateral trust 5 per cent bonds of the El Paso Electric Company, due January 1, 1932, are offered at 98 and interest yielding 5.15 per cent; general mortgage 5 per cent bonds of the Southern California Edison Company, due November 1, 1939, are offered at 96 and interest yielding 5.27 per cent. Among other bonds offered by this firm are those of the Boston & Northern Street Railway Company, Old Colony Street Railway Company, Utica Gas & Electric Company, Oregon Electric Railway Company, Consumers' Power Company, Pensacola Electric Company, and the Texas Traction Company. Estabrook & Company are offering $1,000,000 three-year, 5 per cent gold notes of the Columbus Electric Company, of Columbus, Ga. These are due July 1, 1914, and are callable as a whole, but not in part, on any interest day on sixty days' notice at 101 and interest. The company is under the management of Stone & Webster, and with its controlled companies does the electric railway, electric lighting, gas and power business in the city and vicinity and in two adjoining towns. The proceeds of this issue of notes are to be used for hydroelectric development. The notes are offered at 98 and interest to yield 5¾ per cent.

Back Dividends of Massachusetts Electric Companies.—Commenting on the payment of back dividends of the Massachusetts Electric Companies, a trustee of the companies is quoted as saying: "There is no one more anxious to pay up the $17.75 a share in back dividends on Massachusetts Electric preferred than the trustees, but the company cannot pay out money for back dividends from funds which do not exist. Present earnings, however, are very satisfactory and the time when action can be taken to pay up these back dividends will depend entirely on the growth of net earnings. It speaks well for the Massachusetts Electric system to show an increase of $420,000 in gross earnings during the past year when general business conditions are considered. If the system can show this large increase when the mills in many of the cities served by our lines have placed our patrons on short time and consequently with reduced means for riding, what should our roads show when business picks up and the mills are again running full time with employees prosperous? President Mellen believes in the future growth of New England and is spending millions on his lines from which he expects to derive a good return in the not distant future. The same conditions that will help the Mellen roads will help the Massachusetts Electric system, namely, greater business activity."

Long Acre Electric Light & Power Company Bonds.—A form for a mortgage on the franchises and properties of the Long Acre Electric Light & Power Company, providing for an ultimate bond issue of $50,000,000, was submitted to the Public Service Commission for the First District of New York on Wednesday. The plan calls for an immediate issue of $6,000,000, with a later issue of $4,000,000, and the proposed bonds are to bear interest at the rate of 5 per cent and run for fifty years. A statement made by counsel for the company relative to the $1,000,000 stock issued prior to appointment of the Public Service Commission said that $400,000 of this amount, held in the treasury, will be canceled at once, and that $100,000, collateral security for indebtedness, will be canceled upon payment. Payment of interest or principal on the balance of $500,000 will not be made except upon approval of the commission. Reference to the plans of the company following the issuing of securities was made in the *Electrical World* July 1.

Chicago Elevated Merger.—The National City Bank of New York advertises that it will receive subscriptions for $30,000,000 three-year, 5 per cent gold notes of the Chicago Elevated Railways, of which Henry A. Blair is chairman of the board of directors. Mr. Blair has been at the head of the movement to effect the amalgamation, the progress of which has been cited in the *Electrical World* from time to time. In addition to the $30,000,000 in notes, the capitalization of the Chicago Elevated Railways is to include $16,000,000 in 6 per cent cumulative preferred stock and $20,000,000 in common stock. Further information in connection with the merger will be found on page 146 of this issue.

United Railways of St. Louis.—Arrangements have been made by the United Railways of St. Louis for a ten-year extension at 4½ per cent interest of the $1,500,000 first-mortgage 5 per cent gold bonds of the Lindell Railway Company, maturing Aug. 1. For a limited time the present holders will have the privilege of having their bonds extended and receiving the extended 4½ per cent bonds at 97¾. It is learned further that the discounts, amounting to $27.50 per $1,000, will be paid in cash. Such holders as may not desire to extend their bonds may have them paid at par and interest at the office of the Mercantile Trust Company, of St. Louis.

Springfield Railway & Light Company.—Gross and net earnings of the Springfield Railway & Light Company of Springfield, Mo., in the twelve months ended March 31, 1911, were the largest in the history of the company. The gross earnings were close to $462,000, and the net earnings were nearly $214,000, each showing a gain of some $17,000 over the figures of the previous year. In the last three years, the net earnings of the company have averaged over one and two-thirds the interest requirements on the bonds, and in the twelve months ended March 31, 1911, they were over twice the required amounts.

Maryland Company Changes Hands.—The interests controlling the Frederick Railroad Company, Frederick, Md., have purchased the stock of the Frederick Gas & Electric Light Company.

DIVIDENDS.

Associated Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable July 15.

Electric Company of America, semi-annual, 3½ per cent, payable Aug. 22.

Ft. Smith Light & Traction Company, quarterly, preferred, 1¾ per cent, payable July 15.

Northern States Power Company, quarterly, preferred, 1¾ per cent, payable July 15.

Oklahoma Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable July 15.

Ottumwa Railway & Light Company, quarterly, preferred, 1¾ per cent, payable July 15.

Sierra Pacific Electric Company, quarterly, preferred, $1.50 per share, payable Aug. 1.

Western States Gas & Electric Company, of Delaware, quarterly, preferred, 1¾ per cent, payable July 15.

REPORTS OF EARNINGS.

COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY.

Period.		Gross Earnings	Operating Expenses.	Net Earnings.	Fixed. Charges.	Net Surplus.
May,	1911.....	$422,709	$249,004	$173,705	$103,281	$70,424
"	1910.....	392,792	218,634	174,160	103,926	70,234

LAKE SHORE ELECTRIC COMPANY.

May	1911.....	$105,321	$54,429	$50,892	$34,584	$16,308
"	1910.....	100,424	52,983	47,441	35,035	12,405

MEXICAN TELEPHONE & TELEGRAPH COMPANY.

May,	1911.....	$52,193	$27,746	$24,447	.....	.....
"	1910.....	45,998	22,863	23,135	.....	.....

General News

Construction News.

TUSCALOOSA, ALA.—Application has been made to the Council by F. G. Blair and H. B. Foster for a franchise to construct and operate an electric-light plant in Tuscaloosa.

TEMPE, ARIZ.—Application has been made to the City Council by the Reclamation Service, through C. H. Fitch, local engineer for the Reclamation Service, for permission to erect a 100,000-volt transmission line in Tempe. The proposed line will enter the city from the south at Mill Avenue and Eighth Street, and extend to the government's pumping station on the San Francisco River.

LITTLE ROCK, ARK.—The Little Rock, Pine Bluff & Eastern Traction Company is reported to have secured the right-of-way of the Little Rock & Pine Bluff Traction Company, which will connect Little Rock and Pine Bluff, via Altheimer, Stuttgart, Helena and Clarenden, a distance of 37 miles.

MORRILLTON, ARK.—Preparations are being made by the Morrillton Light & Power Company for the installation of an additional generating unit, consisting of a 150-kw alternator and Corliss engine. This company will supply electricity to operate a large cotton-gin plant which is to be located near by. Judge W. L. Moose is president of the company and G. H. Burr vice-president.

ALAMEDA, CAL.—The City Council has decided to submit the proposition to issue $125,000 in bonds for improvements to the municipal electric-light plant to a vote of the people. Of the proceeds $75,000 will be used for general improvements, $25,000 for a new power house, $15,000 for new wire and $10,000 for miscellaneous equipment.

GLOBE, CAL.—Arrangements are being made by the Tulare Power Company for the main canal which is to take the water out of Tule River, 2 miles above Springfield, returning the same to the river near Globe, where the power house is to be established. It is expected to have the canal completed by the close of the summer, when work will begin on the construction of power house and installation of machinery. The canal will be about 6 miles in length and will provide a head of about 470 ft. Plans are now being prepared by C. H. Holley, chief engineer and promoter of the company, for construction of auxiliary steam plant and substations. The company was recently granted a franchise to erect transmission lines and operate an electric system in Tulare.

KENNETT, CAL.—Preparations are being made by the Northern California Power Company to erect a substation in Kennett. The company is now erecting its transmission lines from Redding to Kennett, which, it is expected, will be completed to this place by Aug. 1.

LOS ANGELES, CAL.—Plans have been completed for the erection of an electric fountain 60 ft. in diameter in Los Angeles, to cost about $5,000. Bids will soon be called for construction of the same.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors until Aug. 31 for furnishing and installing two engine-driven generating units in the Hall of Records Building, plans and specifications for which may be seen at the office of the board.

OAKLAND, CAL.—The Oakland Traction Company has placed an order with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for ten equipments of type HL (non-automatic) unit-switch control.

OAKLAND, CAL.—A proposition has been submitted to the Board of Supervisors by C. N. Beal, manager of the Central Oakland Light & Power Company, offering to supply electricity to the county at the rate of 2¼ cents per kw-hour. The service is now supplied by the Oakland Gas Light & Heat Company for 3 cents per kw-hour. The Central Oakland Light & Power Company is a subsidiary company of the United Properties Corporation and has a steam generating plant at Second and Alice Streets from which it supplies electrical power to local consumers. An unlimited supply of electrical energy can be obtained by the company from the Mount Hamilton watersheds of the Bay Cities Water Company.

OAK PARK, CAL.—The South Sacramento Power Company has entered into an agreement with the Great Western Power Company which permits it to supply electricity to the territory outside of Sacramento. The South Sacramento Power Company has erected transmission lines in Colonial Heights, Columbia Terrace, Elmhurst, the Maple tract and as far south as the Fruit Ridge Road and is supplying electricity at the same rate charged in the city. Plans are now being made by the company to erect a feed wire through the Riverside district.

REDWOOD CITY, CAL.—The City Trustees have granted Edward S. Fitzpatrick a franchise to construct and operate an electric railway from Redwood City to Woodside, a distance of about 6 miles.

SACRAMENTO, CAL.—It is reported that the State Legislature has made an appropriation of $103,000 for a power plant to be equipped with both gas and electrical machinery.

SACRAMENTO, CAL.—Negotiations have been closed between the North Sacramento Land Company and the Great Western Power Company, whereby the latter will supply North Sacramento with electricity for lamps and motors. Work will soon begin on the erection of the distributing system. It is expected to have the system installed and ready for operation by Aug. 1.

SACRAMENTO, CAL.—The Great Western Power Company has secured a large number of contracts in Sacramento in addition to the contract secured from the State recently to supply electricity for lamps and motors at the Capitol and Capitol Park. At present the company is furnishing energy for power purposes only in Sacramento, but will probably supply electrical service to small consumers for all purposes through a separate company, of which, it is said, George W. Peltier will be the head.

SAN DIEGO, CAL.—Steps are being taken by a Citizens' Committee to secure for San Diego a large electrical power plant for municipal purposes with a view of furnishing the city with electrical service at much less than is now charged by the San Diego Consolidated Gas & Electric Company. Private capital is making an effort to interest the municipal authorities in a water power project.

SAN FRANCISCO, CAL.—Orders have recently been placed by the San Francisco, Oakland & San Jose Railroad Company, of San Francisco, Cal., with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for twenty-five double equipments of No. 302 railway motors and type M control.

SAN RAFAEL, CAL.—Plans are being made by the Pacific Gas & Electric Company for extensive improvements in its service in Marin County, which will involve the expenditure of a large amount of money, and will include the installation of a 5000-kw steam turbine at some point in the southern part of the county, which will be used as an emergency plant to supply high-tension transmission lines. The company is also making arrangements to extend its gas mains to the Bush tract and ultimately to Deer Park. Announcement will soon be made by the company of a reduction in the price of electricity for commercial purposes of 2 cents per kw-hour, and for power purposes a reduction of 3 cents per kw-hour will be made upon a yearly guarantee. Wallace H. Foster is local manager.

SANTA ANA, CAL.—The question of installing a new street-lighting system in Santa Ana is under consideration. The Southern California Edison Company, of Los Angeles, has the contract for street lighting.

STOCKTON, CAL.—Plans are being made for the construction of an electrical railway from Stockton to Byron, which will ultimately be extended to Antioch and Oakland. The company will be known as the Stockton & Bay City Short Line, and operated as an auxiliary company, and capitalized at $750,000. Articles of incorporation will be filed soon for the controlling corporation, which will be capitalized at $1,000,000.

PUEBLO, COL.—Investigations are being made by J. Fred Anderson and Charles L. Wuertz, of New York, who, it is said, represents Eastern capitalists, in this section with a view of developing the water-power in the Arkansas River in the Royal Gorge to secure power to operate a large hydroelectric power plant. The plan calls for the construction of a large dam across the canon west of Canon City, which would at least be 1000 ft. high. The proposed plant would supply electricity in Pueblo and other cities in the Arkansas valley and furnish power to operate an interurban railway system over the entire southern part of the State and to light the entire valley.

BRISTOL, CONN.—Orders have been placed by the Bristol & Plainville Tramway Company with the General Electric Company for complete equipment for power plant, including two 937-kva horizontal turbine generator units, switchboard, rotary converters, motor-driven and turbine-driven exciters, etc. The switchboard contains twenty-five panels, forming one main station board and one substation board. The main station board will be alternating-current and will control two 937-kva generators and two 25-kw exciters provided with voltage regulators. The substation switchboard, which will control three 300-kw, 600-volt rotary converters, consists of three alternating-current and three direct-current rotary-converter panels and three alternating-current rotary-converter starting panels. Provision is also made for two panels controlling single-circuit railway feeders. The outfit also includes three 50-lamp, 66-amp mercury-arc rectifiers for street arc lamps.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Washington, D. C., until Aug. 1 for furnishing lamp standards and brackets that may be required for various buildings under the control of the Treasury Department, in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is Supervising Architect.

DAYTONA, FLA.—The proposition to grant the Schantz Electric Light Company, of Daytona, a new franchise in Daytona was defeated.

BARNESVILLE, GA.—Arrangements have been completed by the Central Georgia Power Company, of Macon, Ga., to extend its transmission lines to Barnesville. The company will supply electric service to the city and numerous manufacturing plants here. It is expected to have the system ready for operation by Sept. 1.

BAXLEY, GA.—The installation of a municipal electric-light plant in Baxley is reported to be under consideration.

CUTHBERT, GA.—Bonds to the amount of $20,000 have been sold by the city of Guthbert, Ga., the proceeds to be used for improvements to the municipal electric-light plant and water-works system, work on which will begin in the near future.

ROCKMART, GA.—J. S. Davitte, of Rockmart, Ga., is reported to be in the market for equipment for a 10-mile street railway system, including electric plant, wiring, etc., and four cars.

SAVANNAH, GA.—Application has been made by the Joseph Hull Company for a charter to be capitalized at $60,000 with the privilege to increasing it to $1,000,000. The company proposes to deal in real estate, stock and bonds, warehouses, water, steam and electric power plant, boats, etc., and in all business in which motive power is developed. Joseph Hull, Alexander B. Hull and Daniel B. Hull are interested in the project.

FREMONT, IDAHO.—The plant and holdings of the Fremont County Independent Telephone Company have been purchased by the Capital Electric Company, of Salt Lake City, Utah. It is understood that the purchasers have made arrangements to ask for new franchises in a number of towns in Idaho for the purpose of extending the system from St. Anthony, the central point of the Fremont County system. R. W. Nicol is president of the Capital Electric Company.

BLANDISVILLE, ILL.—The installation of an electric-light plant in Blandisville is under consideration. The Village Council is said to be offering inducements in way of a franchise for installation of an electric-light system.

CARROLLTON, ILL.—A committee, consisting of Mayor Waggoner, S. E. Pierson and B. C. Hodges, has been appointed to look into the matter of securing an extension of the Alton, Jacksonville & Peoria Interurban Railway from Jerseyville to Carrollton. The cost of the proposed branch is estimated at about $250,000. Edgar M. Davis is president of the company.

CHICAGO, ILL.—The Chicago Association of Commerce has engaged Louis H. Evans, former chief engineer of the Chicago Junction Railway, and Hugh Patterson, who supervised the electrical equipment of the New York terminals of the Pennsylvania Railroad Company, to prepare plans for complete electrification of all steam terminals in Chicago.

CHICAGO, ILL.—Announcement has been made of definite steps toward the organization of the Chicago Suburban Edison Company, which, it is said, will control the electric light and power business in Northern Illinois outside of Chicago. An offer will be made to the stockholders of the Economy Light & Power Company, the North Shore Electric Company and the Illinois Valley Gas & Electric Company to deposit their stock under a merger agreement. A majority of the stock of the three companies is owned or controlled by the Commonwealth Edison Company. The combined capital stock of the three companies to be merged into the Chicago Suburban Electric Company is $11,977,000, and the combined funded debt is $9,751,000. The companies have plants and substations in 200 municipalities and serve about 1,000,000 customers.

ELGIN, ILL.—The Aurora, Elgin & Chicago Railroad Company has subscribed $5,000 to the Elgin outer belt line fund. The Western United Gas & Electric Company has given a similar amount.

FOREST PARK, ILL.—The construction of an electric railway between Berwyn, Forest Park, Lyons and Cicero is reported to be under consideration. Henry J. Mohr, of Forest Park, Ill., and associates are interested in the project.

FREEPORT, ILL.—The construction of an electric interurban railway between Freeport and Dixon is reported to be under consideration. L. H. Burrell, Robert Kuehner, Jacob Weiss and J. W. Miller are said to be interested in the project.

GALENA, ILL.—The construction of an electric railway from Galena to Sinsinawa Mound, 14 miles in length, tapping a large mining region, is under consideration. The Galena Commercial Club has taken up the matter.

GENEVA, ILL.—The installation of an independent power plant to supply electricity for lamps and motors for the county court house and jail at Geneva is under consideration by the court house committee of the Board of Supervisors. At present electricity for the court house is generated at the county almshouse and transmitted by cables to the court house. By the installation of a new dynamo in the boiler-room of the court house it is estimated that sufficient power could be obtained to light the buildings.

GIBSON CITY, ILL.—Work has commenced on the erection of the power house, 60 ft. x 57 ft., in Gibson City, for the electric plant of the Central Electric Light & Power Company.

LENA, ILL.—Orders have been placed by the Lena Electric Light & Power Company with the Westinghouse Electric & Manufacturing Company for two 75-kw, 3-phase, 2300-volt, 60-cycle, 900-r.p.m. generators, belted, with exciters and switchboard.

LODA, ILL.—Arrangements have been made with the Paxton Electric Company, of Paxton, Ill., to supply electricity to light this village. The company will erect a transmission line from its power house to Loda. The local distribution system, owned by Addems, Morgan Company, of Loda, has been purchased by Matthew Coffey, who, it is said, will have charge of the local system.

MOUNT CARMEL, ILL.—The United States Court has directed the plant of the Mount Carmel Gas & Electric Company to be sold at auction Aug. 14, to satisfy claims amounting to $250,000.

PRINCETON, ILL.—Plans are being considered by C. N. Gerard, of Bradford, for the construction of an electric railway to extend from Kewanee to Henry, Elmira and Bradford, a distance of about 40 miles.

VIRGINIA, ILL.—The Virginia Light, Heat & Power Company is reported to be contemplating the installation of a new street lighting system.

CRAWFORDSVILLE, IND.—The new municipal electric-light plant was put into operation for the first time June 20. The service will be changed from the old to the new plant gradually.

GREENCASTLE, IND.—The plant and holdings of the Greencastle Gas & Electric Company are reported to have been purchased by W. A. Martin, of Laporte, Ind., and associates. It is said that the new owners contemplate improvements to both plants.

INDIANAPOLIS, IND.—The Indianapolis, Chicago & Meridian Railway Company, it is reported, is planning to erect new power stations at Monticello and at Indianapolis. M. J. Mooreland is interested in the company.

KOKOMO, IND.—Contracts have been awarded by the Kokomo, Frankfort & Western Traction Company, recently incorporated, for the construction of its proposed electric railway to connect Kokomo and Frankfort and intermediate towns. The company will also supply electricity for lamps and motors to the towns, villages and farmers along the line.

NEW CASTLE, IND.—The plant and holdings of the New Castle Light, Heat & Power Company have been purchased by W. A. Martin, of Laporte, Ind., and associates. The property includes both gas and electric plants. The new owners, it is said, contemplate making improvements and extensions, including the installation of new machinery.

TERRE HAUTE, IND.—Contracts have been placed by the Terre Haute, Indianapolis & Eastern Traction Company, of Terre Haute, Ind., with the General Electric Company, of Schenectady, N. Y., for two 300-kw rotary converters, fifteen 100-kva transformers and a switchboard. The rotary converters and six of the transformers will be installed in the Maywood substation. Six transformers will be installed in the substation at Mooresville and three in the Martinsville substation. The transformers are oil-cooled, 25-cycle, 33,000 volts primary and 390 secondary. The switchboard will be installed at the substation in Maywood and will control incoming lines, the bank of step-down transformers and the rotary converter.

WAKARUSA, IND.—The Council has granted a franchise to the Electric Light & Power Company. It is said that the company will install a plant at once.

DES MOINES, IA.—The Des Moines City Railway Company has placed orders for a portable substation to be used on its lines during congested traffic.

DES MOINES, IA.—Plans are being made by the Des Moines City Railway Company for building an addition to its power plant, located at East Maple Street and the river, which will be equipped with a 2000-kw, low-pressure turbine with necessary condensers, switchboard and transformers. A new coal and ash-conveying plant and an electrically operated, 30-ton crane will also be installed in the power house. A 300-kw rotary converter will be installed at the station at Klondike Junction, north of Grand View Park, and a 500-kw rotary converter at the Flint Junction station.

KEOKUK, IA.—Steps have been taken toward the organization of an interurban railway, which is to be known as the Interurban Railway Company, to build an electric railway to connect Keokuk and Fort Madison, Ia., Quincy, Carthage, Hamilton and Niota, Ill. The cost of constructing the proposed railway from Quincy to Niota, Ill., is estimated at $1,500,000. Subscriptions amounting to $15,000 have been raised to extend the railway from Niota to Fort Madison.

POCAHONTAS, IA.—It is reported that petitions will be presented to the City Council asking that another election be called to vote on the proposition to issue bonds for the construction of an electric-light plant. The bonds recently voted have been declared illegal.

VAN HORN, IA.—The plant of the Van Horn Electric Light & Power Company was destroyed by fire on June 29, causing a loss of about $14,000.

FORT SCOTT, KAN.—The Atlas Coal Company has awarded the contract for the construction of an electric-light and power plant at its mine at Rich Hill. The proposed plant will supply electricity for lighting and operating the machinery in the mines.

HORTON, KAN.—Preparations are being made by the city of Horton for the installation of three 100-hp steam boilers, equipped with oil burners, in the municipal electric-light and water plant, bids for which have been received. B. B. Norris is city clerk.

MINNEAPOLIS, KAN.—At a special election held June 20 the proposition to issue bonds to the amount of $15,000, the proceeds to be used for the construction of a municipal electric-light plant, was carried.

PERRY, KAN.—A movement has been started for the installation of an electric-light plant in Perry.

GRAND CANE, LA.—A movement is under way for the installation of an electric-light and water-works system in Grand Cane.

LAFAYETTE, LA.—The City Council is reported to have decided to install two Deisel gas engines. It is proposed to change the system from direct current to alternating current as soon as arrangements can be made to float the certificates of indebtedness. The cost of the work is estimated at about $40,000.

FARMINGTON, MAINE.—The property of the Farmington Electric Company was purchased by A. Studley Hart, of Providence, R. I., on June 29 at a foreclosure sale. Mr. Hart represented the bondholders. This company has no connection with the Farmington Electric Company which is now operating in this place. The old company generated electricity at a steam-power plant located in Farmington, while the present company secures electrical energy from the hydroelectric plant of the Franklin Power Company, located on the Carrabasset River.

BALTIMORE, MD.—At a special meeting of the stockholders of the United Railways & Electric Company held July 5 it was voted to authorize the issue of $3,125,000 in three-year collateral 5 per cent coupon notes.

LITTLETON, MASS.—Three companies are reported to have submitted bids to furnish electricity in the town of Littleton—the Lowell Electric Light Corporation, of Lowell, Mass.; the Edison Electric Illuminating Company, of Boston, Mass., and the Connecticut River Power Company, at Brattleboro, Vt. The lines of each company reach the town within 10 miles, and the Edison Company will furnish electrical service in Carlisle within a short time, about 8 miles east of Littleton. This town is soon to install a public water service, an act enabling it to do so having just passed the Legislature, and it is probable that the pumping service will be operated by the company that supplies the electrical service.

REVERE, MASS.—The citizens of Revere have applied to the Gas and Electric Light Commission for a reduction in the price of electricity charged by the Suburban Gas & Electric Light Company.

IRONWOOD, MICH.—The Appleyard interests have taken over the plants, franchises and holdings of the Twin City General Electric Company, the Ironwood Water Works Company, and the Hurley Water Works Company. The Appleyard interests now control all electric properties in Gogebic County and will start at once to develop the water power near Mellen, Wis., and to extend the street railway system from Ironwood to Bessemer, Mich., and to several small towns beyond Bessemer.

NEWBERRY, MICH.—It is reported that the Village Council is contemplating the installation of new machinery at the municipal electric plant, to cost about $4,000. The citizens recently voted against the proposition to issue $11,000 in bonds for the construction of a new electric plant.

TROWBRIDGE, MICH.—Preparations are being made by the Commonwealth Power Company to rebuild its plant, recently destroyed by fire, at once. The power house together with all the equipment is practically a total loss. It is understood that new equipment will be ordered and work on reconstruction will begin immediately.

DEERWOOD, MINN.—The Cuyuna Range Light & Power Company is endeavoring to place contracts for furnishing electricity for lamps and motors to the towns of Staples, Wadena, Aitkin and Perham. The steam plant of the company is located in Deerwood. The company is making arrangements to erect a hydroelectric power plant at or near the Crow Wing River. The company is also making arrangements to supply electrical energy to mines in this vicinity. The rate for electrical service in the above town is 4 cents per kw-hour for lamps and 3 cents per kw-hour for motors. M. D. Stoner is manager.

MINNEAPOLIS, MINN.—The City Council is considering the question of installing an incandescent light system consisting of 150 lamps, electricity for maintaining the lamps to be supplied by the plant at the garbage crematory, to cost about $50,000.

MINNEAPOLIS, MINN.—Preparations are being made for rebuilding the New York Life Building, located at Fifth Street and Second Avenue, at a cost of about $100,000. The improvements to be made include the innstallation of new elevator systems, new heating plant, new lighting eystem, etc.

ST. PAUL, MINN.—The City Council of St. Paul has adopted a resolution to join with Minneapolis in promoting a corporation to control the power to be generated by the new government dam. Under a law enacted by the last Legislature provision is made to form such a corporation under the direction of the Mayors of the two cities and the president of the university board of regents. It is believed that power developed at the dam will generate sufficient electricity to light the streets and public buildings of both cities. The corporation, through bonds guaranteed by the two cities, will construct and equip the power plant and will pay the federal government rental amounting to 4 per cent on the cost of the erection of the dam.

ST. PAUL, MINN.—The Consumers' Power Company, which controls the Northern Heating & Electric Company, of St. Paul, Minn., has filed a mortgage for $10,000,000 in favor of the Standard Trust Company, of New York, N. Y., and F. M. F. Miller as trustees, to secure an issue of the same amount in bonds. The Consumers" Power Company, it is said, proposes to purchase small lighting and heating plants in all parts of the State. It is expected that the company will connect the local plant with the water-power projects recently obtained from H. M. Byllesby & Company, of Chicago, Ill., at Cannon Falls, Mankato, Apple River and Blue Earth. The power plant at Blue River is nearly completed. In addition to the sites mentioned the company obtained control of the light and heating plants at Stillwater, South Stillwater, Red Lake Falls, Grand Forks and East Grand Forks. On the Red River site it is understood that 3000 hp can be developed and about 2000 hp will be available at the Blue Earth and Apple River sites. The deal covers practically all of the property held by the company in the State of Minnesota besides that held within St. Paul.

TOWER, MINN.—It is reported that bids will soon be called for the construction of a dam and electric plant at Pike River, to cost from $12,000 to $15,000. D. A. Reed is engineer.

CLARKSDALE, MISS.—Plans are being considered by the City Council for extensions to the water-works, electric-light and sewer systems, to cost about $50,000. W. S. Bobo is general superintendent.

KIRKWOOD, MO.—The committee appointed to make an investigation of the municipal electric-light plant, it is said, will recommend overhauling and maintaining the municipal electric-light plant and an issue of $10,000 in bonds to pay for same.

MONETT, MO.—Bids will be received by the city of Monett until July 18 for furnishing machinery and equipment for the municipal electric-light plant as follows: One 225-hp simple Corliss engine for direct connection to a 150-kw, alternating-current generator; one 90-hp simple side-crank engine for direct connection to a 60-kw, alternating current generator; one 160-hp simple side-crank engine for direct connection to a 100-kw, alternating-current generator; one 4-panel switchboard, three horizontal return tubular boilers, of 100-hp each, with stack; one 500-hp open heater, one 400-hp boiler feed pump complete, pole-line equipment including tungsten lamps, transformers, poles, wire, lightning arresters, etc. Rollins & Westover, Beals Building, Kansas City, Mo., are engineers. Perry Short is Mayor.

SEDALIA, MO.—An order of foreclosure has been entered in the federal circuit court against Sedalia Light & Traction Company, in which the company is given forty days after June 27 to adjust its indebtedness of $807,000 to the City Trust Company, of Boston, Mass.

SPRINGFIELD, MO.—Six double equipments of No. 323 railway motors with type K-10-A control have been ordered from the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., by the Springfield Traction Company, of Springfield, Mo.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company, it is reported, is contemplating the installation of pressure pumps in its power plant this season.

FALLON, NEV.—Arrangements are being made by the United States government for the construction of a large electric plant at the new Lahonton dam for the purpose of supplying electricity to operate the gates and dams of the large Truckee-Carson project and for operating the electrical pumps to drain the Carson Lake. The residents of Fallon have petitioned the government to have this work done at once and to sell power to the city of Fallon.

TUSCARORA, NEV.—The Jack Creek power plant, which supplied electricity for lighting and operating the Tuscarora mines, was totally destroyed by fire on June 22, causing a loss of about $55,000. The plant is located about 20 miles from Tuscarora. It is understood that the plant will be rebuilt, which will take several months.

FABYAN, N. H.—Surveys are being made by the civil engineers of the Boston & Maine Railroad for the construction of the proposed electric railway up Mount Washington, to take the place of the present cog-wheel railroad.

CHATHAM, N. J.—Work has commenced on construction of the power house of the Morris County Traction Company in Chatham. It is expected to have the plant completed in about three months.

ALBUQUERQUE, N. M.—Preparations are being made for the construction of a large hydroelectric power plant on the Gila River, in Grant County, plans for which are being prepared by H. von Schon, of Detroit, Mich. The proposed plant will supply electricity for the mines and mills in the Mogollon mining district.

BINGHAMTON, N. Y.—The City Council has voted to call an election on Aug. 18 to vote on the proposition to issue bonds to the amount of $20,000, the proceeds to be used for the installation of a boulevard lighting system and placing the wires underground on Court Street from Exchange Street to Chenango River.

BUFFALO, N. Y.—The Public Service Commission, Second District, has authorized the Buffalo & Lackawanna Traction Company to expend the sum of $196,000 for the purchase of rolling stock and equipment.

CAMDEN, N. Y.—The installation of an additional engine, to cost about $20,000, in the municipal electric-light plant is under consideration.

CLAVERACK, N. Y.—It is reported that the Red Hook Light & Power Company has applied for a franchise to install an electric-light system in Claverack.

CORNING, N. Y.—The City Council has awarded the contract for street lighting to the Corning Gas & Electric Company for a term of ten years, dating from June 1. The contract calls for the installation of luminous-arc or magnetite-arc lamps to replace the lamps now in use. Under the new contract the company is to furnish arc lamps at $75 each per year, 75-watt incandescent lamps at $25 each per year, 125-watt incandescent lamps at $27.50 each per year, or 40-watt lamps at $18 per lamp per year. Under the present contract the city pays $80 per lamp

per year for arc lamps and $30 each per year for 75-watt lamps. All current used for special street lighting for decorative purposes, cluster lamps, special lighting, etc., will be charged at the rate of 5 cents per kw-hour. Under the new contract the city will save about $7,000 during the ten years. Work will begin soon on the installation of the new system. A number of changes will be necessary in the power house, including the installation of two rectifiers for two 75-lamp circuits and a Tirrill regulator.

NEWBURGH, N. Y.—The Public Service Commission, Second District, has authorized the Orange County Traction Company to issue $83,500 in bonds to be sold for cash at not less than 85, the proceeds to be used for the payment of new property and equipment.

NEW YORK, N. Y.—The Public Service Commission, First District, has adopted a resolution instructing the commission's counsel to submit a form of certification for the third-tracking of the Second, Third and Ninth Avenue elevated railways.

NEW YORK, N. Y.—Bids will be received at the office of William J. Gaynor, Mayor, chairman of Armory Board, Hall of Records, Chambers and Centre Streets, New York, N. Y., until July 20 for furnishing and installing lighting fixtures in the Second Battery Armory, 166th Street and Franklin Avenue, the Bronx, in accordance with plans and specifications, which may be seen at the office of the Armory Board.

NEW YORK, N. Y.—Bids will be received by Patrick A. Whitney, Commissioner of Correction, at the office of the Department of Correction, 14 East Twentieth Street, Borough of Manhattan, New York, N. Y., until July 20 for furnishing machinery, appliances, etc., and labor to lay and draw into ducts and properly connect up a complete electric feeder system, including covers for manholes, for the lighting, including the furnishing and connecting up mechanically and electrically the lamp-posts, lanterns, etc., on Hart's Island, New York. Bids will also be received at the same time and place for furnishing at Hart's Island, New York, lead-sheathed, rubber-covered, single-conductor feeder and sub-feeder cables; also duplex, rubber-covered, lead-sheathed, steel-armored cables. Blank forms and further information may be obtained at the office of the department.

OLEAN, N. Y.—The Olean Electric Light & Power Company has applied to the Public Service Commission, Second District, for permission to issue $185,000 in bonds, the proceeds to be used for the construction and equipment of a new electric plant at Sears and the erection of a high-tension transmission line from Sears to the city of Olean and for improvements to its distributing system in Olean and an additional distributing line to Allegany, N. Y., installing a new arc lighting system in Olean and for refunding of present mortgage indebtedness.

CHARLOTTE, N. C.—The Piedmont Traction Company, of Charlotte, N. C., has placed an order with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for a quadruple equipment of No. 308-B-5 railway motors and special type HL (non-automatic) control. These motors are insulated for operation on 1500 volts. The railway is now nearing completion. T. C. Lee is engineer in charge.

CHARLOTTE, N. C.—Five quadruple equipments of No. 308-B-5 railway motors for operation on 1500 volts, with special type HL (non-automatic) unit-switch control, have recently been ordered by the Greenville, Spartanburg & Anderson Railway Company, of Charlotte, N. C., from the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

RALEIGH, N. C.—It is reported that surveys are being made by the Carolina Power & Light Company for the erection of a transmission line to extend from Raleigh to Goldsboro. The company will supply electricity in Goldsboro for lamps and motors and to operate the street railway system. Electrical service will also be supplied to towns along the route of the transmission line.

AKRON, OHIO.—The Northern Ohio Power Company has awarded the contract for the construction of a large dam across the Cuyahoga River at Cuyahoga Falls to furnish power for operating a portion of its large hydroelectric plant now under construction there. The dam will be located some distance above the falls, and will be about 500 ft. long and about 60 ft. high, built of concrete reinforced with steel. An independent steam power plant will be built above the falls capable of generating about 18,000 hp. The plans include a pleasure resort along the water and a miniature electric railway will be built along each side of the valley.

COLUMBUS, OHIO.—The City Council has authorized the expenditure of $32,000 of the $75,000 appropriated for extending the electric-light system into the new territory. This will be used in purchasing magnetic arc lamps and installing the new safety switchboard at the municipal electric-light plant.

DAYTON, OHIO.—In a special appropriation for city needs the sum of $25,631 was included for the installation of an ornamental street lighting system.

DAYTON, OHIO.—The Western Union Telephone Company is contemplating placing its wires underground and making other improvements to its system in Dayton, involving an expenditure of about $40,000.

DELAWARE, OHIO.—The City Council is considering the question of purchasing the local electric-light plant to be owned and operated by the city or installing a new municipal electric plant. It is understood that the present plant will have to be practically rebuilt.

TIFFIN, OHIO.—The plant and holdings of the Tiffin Electric Company have been taken over by the Ohio Light & Power Company, which was recently organized to take over the plants in Tiffin and other localities.

WARREN, OHIO.—The Trumbull Electric Service Company, of Warren, Ohio, recently incorporated, has increased its capital stock from $10,000 to $1,700,000. The promoters, it is said, plan to consolidate the lighting and traction properties in Trumbull and surrounding counties, including Warren, Girard and Hubbard, Ohio, and Sharon, Pa. This proposition, it is said, has no connection with the Republic Railway & Light Company. Harry M. Daugherty, of Columbus, Ohio, president of the Cities Service Company, which controls properties in several Western cities, is one of the promoters of the company.

YOUNGSTOWN, OHIO.—Preparations are being made by the Mahoning & Shenango Railway & Light Company for extensive additions and improvements to its North Avenue power house, increasing the output to 13,000 kw, an increase of about 50 per cent. The work will include in addition to the power house the installation of a 4000-kw turbine, a 12,000-sq. ft. surface condenser, a 200-hp pump for supplying water for condenser, two 500-hp boilers, boiler-feed pumps and other auxiliaries, contracts for which have already been placed.

KLAMATH FALLS, ORE.—The Klamath Water Users' Association is considering the question of securing the Keno power site to be developed for power and irrigation purposes. It is estimated that a bond issue of between $400,000 and $500,000 will be required to purchase and develop the property.

PORTLAND, ORE.—The Mount Hood Railway & Power Company has been granted permission to erect transmission lines along the streets of the city.

GREENSBURG, PA.—Application has been made to the Borough Council by the West Penn Traction interests for a franchise for the Greensburg Terminal Company. It is proposed to lease the tracks of the Pittsburgh, McKeesport & Greensburg Railway Company and the Greensburg & Southern Electric Street Railway Company in Greensburg and to build extensions within the borough limits. The agreement provides that all the work will be completed within two years after the franchise is granted.

McCALL FERRY, PA.—The Pennsylvania Light & Power Company is planning to add 3 ft. to the McCall dam in the Susquehanna River. The purpose of raising the dam is to guarantee sufficient water to generate the full 100,000 hp at the lowest stage of the water.

PITTSBURGH, PA.—A syndicate consisting of Brown Brothers, Newberg, Henderson & Loeb and H. B. Hollins & Company, New York, N. Y., has underwritten bonds to finance the purchase of the electric lighting and power companies in Waynesboro, Washington, Canonsburg, Oakdale, McDonald, Glenfield, Woodlawn and several other towns in the Ohio River territory acquired by J. S. & W. S. Kuhn, Inc., from the Ely syndicate. The deal involves nearly $3,000,000. Bonds of the Western Pennsylvania Traction Company will be used in financing the purchase of these properties and for extensive improvements to the systems.

TITUSVILLE, PA.—The Titusville Electric Traction Company is reported to have decided to issue additional bonds to provide funds for the construction and equipment of an extension to Cambridge Springs, and an extension southward to Oil City, Pa., will also be made, making a total of 34 miles.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has placed an order with the General Electric Company, of Schenectady, N. Y., for a twenty-seven-panel switchboard consisting of an instrument and controlling benchboard of twenty panels and an exciter and field switchboard of seven panels. This switchboard will control three 3500-kw and one 4000-kw, 2300-volt, 60-cycle turbo-generator. The equipment includes motor oil switches, busbars, meters, instruments, etc.

ANDERSON, S. C.—The Anderson Water, Light & Power Company is reported to be making preparations to install a steam turbine generating plant to have an output of about 1600 hp. The cost of the proposed plant is estimated at $50,000 and the equipment includes condensers, cooling towers, switchboards, transformers, etc. It is understood that the substation buildings are to be enlarged to provide for the new machinery.

EDGEFIELD, S. C.—Bonds to the amount of $15,000 have been sold, the proceeds of which will be used to establish a municipal electric-light plant. Bids for construction of the plant will be asked for soon.

ARLINGTON, S. D.—The installation of an electric-light plant in Arlington is reported to be under consideration. George Johnson is said to be interested in the project.

RAPID CITY, S. D.—A private electric-lighting plant will be installed in the new McKenna Hospital, now being erected. A concrete subway will be built and electric elevators installed.

WHITE LAKE, S. D.—A canvass of the town is being made with a view of securing patrons for a proposed electric plant. A local capitalist, it is said, will install a plant if sufficient patronage is guaranteed to pay for establishing such a plant.

BRISTOL, TENN.—The Bristol Gas & Electric Company has been granted a franchise by the County Court of Sullivan County to supply electricity in the county outside of Bristol. The company has recently contracted with the Watauga Power Company to take a large amount of energy generated at its hydroelectric plant, located at Horseshoe Bend on the Watauga River. The Bristol company proposes to extend its service to all parts of the county.

KNOXVILLE, TENN.—The Council of Mountain View has granted the Ocoee Power Company, of Polk County, a franchise to supply electricity in that municipality for lamps and motors. It is expected to have the system ready for operation in Mountain View by Jan. 1, 1912.

KNOXVILLE, TENN.—The Knoxville Electric Light & Power Company has purchased from the Westinghouse Electric & Manufacturing Company one 150-kw, 3-phase, 2300-volt, 60-cycle, 600-r.p.m. generator, belted, with exciter; one 50-kw, 3-phase, 2300-volt, 60-cycle, 1200-r.p.m. generator, belted, with exciter and one five-panel switchboard.

LOUDON, TENN.—Surveys are being made by the East Tennessee Light & Power Company for the erection of its transmission line into Loudon from its power plant now being built on the Ocoee River at Parksville.

McKENZIE, TENN.—Sealed proposals will be received by the Board of Aldermen and Mayor of McKenzie, Tenn., until July 27, for the construction of an electric-light plant and water-works system. For further information address F. D. Walpole, Recorder, McKenzie, Tenn. C. H. Jenks, of Union City, Tenn., is engineer.

AUSTIN, TEX.—The City Council has accepted the proposal submitted by William D. Johnson, of Hartford, Conn., and New York, N. Y., for the construction of a dam across the Colorado River at Austin and the installation of a hydroelectric plant, subject to ratification by referendum vote by the people. The consideration is $1,600,000, to be paid in twenty-five instalments.

BROWNSVILLE, TEX.—Application has been made to the City Council by J. C. Debruin, of Brownsville, for a street railway franchise covering the principal streets of the city.

DALLAS, TEX.—The Stone & Webster Engineering Corporation, which is preparing to construct an interurban electric line between Dallas and Waxahachie, Tex., a distance of 30 miles, is securing right of way for the road. It is proposed to ultimately extend the railway south to Waco and also to Corsicana, for which preliminary steps have been taken. It is reported that the Stone & Webster Engineering Corporation proposes to build an electric interurban railway extending from Sherman, on the north, to Galveston, on the south, traversing the most populous part of the State.

MARSHALL, TEX.—Arrangements are being made by the Marshall Traction Company for extensions to its system, including an extension to its line in North Marshall. The residents in that portion of the city have raised a liberal bonus toward the proposed extension.

PORT LAVACA, TEX.—Two franchises have been granted by the City Commissioners to two companies to operate electric-light and power plants and water-works systems in Port Lavaca. One was granted to C. J. and J. K. Spittal, owners of the Port Lavaca ice and power plant, and the other to W. E. Shell, representing a new company.

TAFT, TEX.—An electric-light plant is being installed by the Coleman-Fulton Pasture Company to supply electricity for lighting the town.

TIOGA, TEX.—A proposition has been submitted to the Commercial Club by A. L. Marshall regarding the installation of an electric-light plant in Tioga.

LAUREL HILL, VA.—Surveys have been made for the location of a dam and hydroelectric power plant, which is to supply electricity in Laurel Hill.

LAWRENCEVILLE, VA.—At an election to be held Aug. 1 the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of an electric plant, water-works and sewer system, will be submitted to a vote. D. S. Hicks, Jr., is Mayor.

PULASKI, VA.—The Appalachian Power Company, which contemplates five water-power developments and the construction of two storage reservoirs on the New River, in Virginia, details of which were given in the issue of July 7, has secured the use of the new 5350-hp steam turbine plant of the Pocahontas Collieries Company to serve as a reserve to its water-power plants. Duplicate transmission lines are to be erected to Bluefield, one by the way of Wytheville, and the other through Pulaski. A single transmission line from Pulaski to Roanoke, a distance of 48 miles, is under consideration. Secondary high-tension lines will be erected to the iron mine regions along the New River, to Princeton in the vicinity of Pulaski and to other collieries. It is said that about fifteen months will be required to complete the water-power plants, transmission lines and other construction work. H. M. Byllesby & Company, of Chicago, Ill., are consulting engineers and will operate the plants when completed. Messrs. Viele, Blackwell & Buck, of New York, N. Y., are the designing and constructing engineers.

SMITHFIELD, VA.—The installation of an electric plant is reported to be under consideration by the Smithfield Water Company. B. P. Gay is manager.

LACROSSE, WASH.—The Washington Water Power Company is reported to be contemplating extending its transmission lines from Colfax to Lacrosse.

OLYMPIA, WASH.—Proposals will be received by the State Board of Control, Olympia, Wash., until July 20 for one 20-kva, two-phase, 220-110-volt generator, direct-connected to a vertical 10 x 10 (or equivalent) engine, with belted exciter. Specifications and further information can be obtained at the office of the Evans-Dickson Company, consulting engineer, 725 Commerce Street, Tacoma, Wash.

PORT ORCHARD, WASH.—The Bremerton & Charleston Light & Fuel Company, it is reported, has applied to the County Commissioners for a franchise to erect transmission lines on certain streets and roads to supply electricity for lamps and motors.

PORT TOWNSEND, WASH.—The Olympic Power Company, which is erecting a power plant on the Elwha River in Clallam County, is making surveys for the erection of its transmission lines to supply electricity to the various cities and towns on the Olympic peninsula. The line has been located to Port Angeles and surveys have been made as far as Sequim, which is being extended toward Port Townsend and Irondale, where numerous contracts have been placed for electrical service. Contracts have been signed by the city of Port Townsend for light purposes and by the Western Steel Corporation, of Irondale, for electricity for both lamps and motors.

PROSSER, WASH.—The Pacific Power & Light Company has commenced work on improvements to its plant, which will involve an expenditure of about $15,000 and include the installation of three 66,000-volt new transformers and a 600-kw generator.

WALLA WALLA, WASH.—The Northwestern Gas & Electric Company has acquired rights of way for power site purposes from the mouth of the White Salmon River for a distance of 5 miles and within 2 miles of Husum.

WALLA WALLA, WASH.—A deal has been closed whereby the Attalia Land Company has purchased the holdings of the Columbia Canal Company in the Attalia irrigation project. The new company proposes to irrigate a large tract of land in this vicinity and to install a large number of pumps, operated by electricity, to supply water from the river close by. Robert Grinnell, of Spokane, Wash., is president.

CHARLESTOWN, W. VA.—The power plant of the Charlestown Light & Power Company was sold June 24 by John O. Lemon, trustee, to Thomas C. Bowling and others for $16,500.

MORGANTOWN, W. VA.—Contracts are being taken by the Pittsburgh Hydroelectric Company, promoter of the Big Sandy dam project, to supply electrical service from the large power plant. It is stated that one of the falls which will be created by the large dams will be 675 ft. high. Benedum & Trees, Pennsylvania capitalists, are said to be interested in the enterprise.

WHEELING, W. VA.—The Wheeling Traction Company is making improvements to its power house in Wheeling.

MILWAUKEE, WIS.—The City Council has adopted the report of the Finance Committee recommending that $6,000 be appropriated to engage engineers for preliminary work of the municipal electric-light plant. An appropriation of $6,000 has been vetoed by Mayor Emil Seidel, owing to its being illegal, the appropriation having been made before the fund was created.

RACINE, WIS.—The Milwaukee Electric Railway & Light Company has notified the City Council that it will make a reduction in the price of electricity for lamps in the parks. The company also states that plans are being made for improvements to the local system and that new cars will be in operation before winter. It also states that it is willing to construct a street railway on Grand Avenue, Fourteenth and Sixteenth Streets to Asylum Avenue if the people petition for same.

EDMONTON, ALTA., CAN.—The ratepayers on June 19 defeated the by-law authorizing an expenditure of $100,000 for a power development at Grand Rapids on the Athabaska River, about 200 miles north of the city, in connection with the municipal electric plant. It is believed that the project would cost between $3,000,000 and $4,000,000.

PENTICTON, B. C., CAN.—Tenders will be received by F. H. Latimer, consulting engineer, Penticton, B. C., until Aug. 10, for furnishing and installing equipment for the municipal hydroelectric plant as follows: Two 100-kva, three-phase, 4600-volt, 900 r.p.m., alternating-current generators, direct-connected to impulse wheels operating at 2045 ft. effective head; pressure pipe line, about one mile of 10-in. pipe and one mile of 12-in. pipe; switchboards, transformers, meters, distributing and street lighting system. Plans and specifications may be seen at the office of the consulting engineer, Penticton, B. C., and Mather, Yuill & Company, Ltd., Vancouver, B. C.

BRANDON, MAN., CAN.—Tenders will be received by Harry Brown, clerk of Council, Brandon, until July 17 for two 2,000,000-gal. variable speed pumps and other machinery necessary to equip the municipal pumping station to be operated by electricity, and to be installed so as to permit the present steam plant to be used as a duplicate. Tenders will also be received for a Diesel gas engine of same capacity.

COBALT, ONT., CAN.—Negotiations have been completed whereby the Temiskaming and Northern Ontario Commission has purchased the Nipissing Central Railroad, for $250,000, which will be operated as a branch of the Temiskaming & Northern Ontario Railway. The line will be extended to the water's edge at Haileyburg, and into the government's station at Cobalt, and later through New Liskeard and into Quebec Province as far as Quanse, and also south from Cobalt to Latchford, a distance of 10 miles. Extensive improvements are contemplated to the railway, including the equipment of the road for electrical operation. A company has been formed to operate the road, of which J. L. Englehard is president and A. J. McGee, secretary and treasurer.

HAMILTON, ONT., CAN.—The Colonial Engineering Company, of Montreal, Que., Can., is reported to be seeking to obtain franchises to build and operate electric-light plants, water-works systems and street-railway lines in towns and territories now without such service or purchasing existing properties with a view of combining them into one

property. The company may be given an opportunity to take up the Hamilton, Waterloo & Guelph Railway project and also the old Caledonia & Lake Erie Railway proposition. L. G. Read is president of the company.

PETROLIA, ONT., CAN.—A temporary arrangement has been made between the municipality and the Petrolia Electric Light, Heat & Power Company, whereby the streets are lighted again by electricity. Owing to a disagreement between the Council and the company the service was discontinued. The contract, which is only in effect from month to month, provides for the following rates: A discount of 25 per cent on all commercial lighting, if paid by the 10th of the month, and $55 each for arc lamps, of which there are thirty-eight, the ten lamps installed by the municipality to be free. The light committee is making investigations with the view of installing a municipal plant in connection with the Hydro-Electric Power Commission's service. The plant operated by the company is considered obsolete. R. Stirrett is chairman of the light committee.

PORCUPINE, ONT., CAN.—The Porcupine district of Northern Ontario has been swept again by forest fires destroying the power plants and camps of the Dome Extension. Porcupine has not a post office.

WELLAND, ONT., CAN.—The Town Council has engaged an electrical engineer to make an appraisal of the electric plant of the Welland Electrical Company with a view of purchasing the same, to be owned and operated by the municipality.

New Industrial Companies.

THE ELECTRIC RESISTANCE COMPANY, of St. Louis, Mo., has been incorporated by William A. Phillips, Frank M. Rumbold, of Jefferson City, Mo.; James H. McCord, of St. Joseph, Mo., and Ralph L. Smith and A. V. Reyburn, Jr. The company is capitalized at $2,000, and proposes to manufacture and deal in all kinds of supplies used for resistance conductors and all other kinds of electrical devices.

THE EXCELSO STORAGE BATTERY COMPANY, of San Marcos, Tex., has been granted a charter with a capital stock of $10,000 by A. B. Rogers, A. E. Lawrence and P. A. Hofheinz.

Personal.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, left Chicago on July 6 for a month's absence which he will spend in a flying trip to Europe.

MR. EDWARD P. RICH, of Chicago, a member of the firm of Pierce, Richardson & Neiler, consulting engineers, was married to Miss Lilabel Griffiths, of the same city, on June 24.

PROF. WILLIAM G. RAYMOND, dean of the college of applied science at the University of Iowa, has been elected president of the Society for the Promotion of Engineering Education.

MR. THOMAS A. EDISON, whose alkaline storage battery holds the record (244.5 miles) for travel of a vehicle on one charge, has been elected an honorary member of the French Automobile Club.

PROF. ROBERT A. MILLIKAN, of the department of physics of the University of Chicago, well known for his work relating to the isolation of the ion, has been given the degree of doctor of science by Oberlin College.

COL. SAMUEL REBER, of the Signal Corps, United States Army, has been detailed by Gen. Leonard Wood, chief of staff, to attend the international aviation meet to be held at Grant Park, Chicago, on August 12 to 20.

MR. N. B. AYERS has resigned as chief engineer of the Dayton Power & Light Company, and has organized the Ayers Engineering Company, which will engage in engineering, with offices in the Conover Building, Dayton, Ohio.

MR. EDWARD RIEDEL has resigned as general manager of the Walnut Ridge & Hoxie Light, Power & Transit Company, Walnut Ridge, Ark., to accept the position of electrical engineer and master mechanic of the Doe Run Lead Company, Rivermines, Mo.

MR. L. H. EVANS has been appointed terminal engineer for the committee on railroad terminal electrification organized by the Chicago Association of Commerce. Mr. Evans has been consulting engineer for the Chicago Junction Railway Company.

PROF. L. V. LUDY, of the department of mechanical engineering of Purdue University, has been granted a year's leave of absence for the forthcoming school term, during which he will be located at Madison, Wis., engaged in research and instructional work at the University of Wisconsin.

MR. O. H. LINTON has resigned from the staff of Niles-Bement-Pond Company, New York, to become associated with Messrs. Griggs & Holbrook, consulting engineers, 3 South William Street, New York, and will have charge of their Canadian business with headquarters at 23 Scott Street, Toronto.

GENERAL MORRIS SCHAFF has been reappointed by Governor Foss as a member of the Massachusetts Gas and Electric Light Commission, to which office he was first appointed in 1893. General Schaff is a graduate of West Point, has a notable Civil War record, and is the author of several works on military subjects. In politics he is a Democrat.

PROF. S. M. KINTNER, of the electrical engineering department of the University of Pittsburgh, has resigned his position as engineer in the railway department of the Westinghouse Electric & Manufacturing Company to become general manager of the National Electric Signal Company, which controls the Fessenden wireless telegraph and telephone systems.

MR. WALTER J. WARDER, JR., formerly motor designer for Roth Brothers & Company, of Chicago, and more recently of the industrial and power department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, has returned to Chicago and is now connected with the Adams & Westlake Company, of that city, doing development work in electrical engineering.

MR. A. A. TIRRILL, well known as the inventor of the voltage regulator bearing his name, has undertaken development work in the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. For the past two years, since leaving the General Electric Company, Mr. Tirrill has been president of the Tirrill Manufacturing Company, Athens, Pa.

MR. EVAN J. EDWARDS has been appointed associate engineer in the engineering department of the National Electric Lamp Association, Cleveland, Ohio. Mr. Edwards was instructor in electrical engineering at the Massachusetts Institute of Technology for three years after his graduation from the University of Iowa, in 1907. For the past year he has been in charge of the course of instruction in illuminating engineering which is given to new technical graduates coming with the National Electric Lamp Association.

MR. W. H. HODGE, publicity manager for H. M. Byllesby & Company, has an article entitled "Plans That Won Profit for Public Utilities," in *Judicious Advertising* for July. Mr. Hodge describes among other things the recent newspaper advertising campaign to secure the electric wiring and equipment of old dwellings. The campaign lasted from Oct. 1 to Nov. 15, and in seventeen cities where it was tried 1468 house-wiring contracts were secured, at an average cost to the local companies, including cost of advertising, cost of soliciting and wiring contractor's profit, of $4.83.

MR. WILLIAM ARTINGSTALL, division engineer of tunnels and subways for the Board of Supervising Engineers, Chicago Traction, gave a talk on "City Tunnel Work" at the luncheon of the Electric Club of Chicago on July 5. He described the La Salle Street tunnel of the Chicago Railways Company under the Chicago River, and showed how it was built for ultimate subway connection. Beneath this tunnel is another one for water pipes and electric and other conduits. This second tunnel is built of concrete, and is about 11 ft in diameter, of horseshoe shape. Its bottom is 83 ft below the surface of the river. Brick shafts at either end serve to bring the pipes of the utilities up near the surface.

MR. V. H. GREISSER, electrical engineer for the Washington Water Power Company, Spokane, Wash., is making a five weeks' inspection tour in the East. While the main purpose of Mr. Greisser's visit is to select the switchboard apparatus for the new 90,000-hp hydroelectric plant which the above company is building at Long Lake, 30 miles from Spokane, he will also visit the power plants and transmission systems at Niagara and Schenectady and in North Carolina. The Long Lake plant will, when completed, have four 22,500-hp turbines now being built by the I. P. Morris Company, of Philadelphia. The generators will have a rating of 13,900 kva and will be designed for 25 per cent continuous overload. The dam for this plant will have a spillway 180 ft. high, the highest in the world. Roller dams, built in Germany, will be used there for the first time in this country.

HON. CHARLES A. PARSONS, F. R. S., well known as the inventor of the steam turbine bearing his name, was honored by the King of England on the occasion of his coronation by being appointed Knight Commander of the Bath. Mr. Parsons is the son of the fourth Earl of Rosse and grandson of the third earl, who built the famous telescope at Birr. He was elected a fellow of the Royal Society in 1898 and an honorary member of the (British) Institution of Electrical Engineers in 1909. He is managing director of the Parsons Marine Steam Turbine Company and director of the Cambridge Electric Supply Company, the Scarborough Electric Supply Company and the Parsons Foreign Patents Company. The Royal Society of Arts recently awarded to him the Albert medal for his experimental researches into the law governing the efficient action of steam in turbines and his invention of the reaction type of turbine.

PROF. JAMES A. EWING, F. R. S., best known for his pioneer investigations of molecular magnetic phenomena, was the recipient of an honor in the appointment as Knight Commander of the Bath by King George V on the occasion of his coronation. Professor Ewing was educated at the University of Edinburgh as an engineer and he entered upon engineering work immediately after graduation. He was professor of mechanical engineering at the Imperial University, Tokyo, Japan, from 1878 to 1883, when he was appointed professor of engineering at the University College, Dundee. In 1890 he became professor of applied mechanics at the University of Cambridge. In 1903 he was appointed director of naval education, which position he now holds. Professor Ewing has published various papers on scientific subjects, his classical paper on magnetic induction in iron and other metals having been published in 1891. In 1879, at the age of twenty-four he married Miss Anna Washington, daughter of the late T. B. Washington, Claymont, W. Va.

MR. H. F. GURNEY, president of the Gurney Elevator Company, of New York, and the Gurney Electric Elevator Company, of Honesdale, Pa., which on June 1 succeeded to the business of the National Elevator Company, began his connection with the elevator industry immediately after graduation from Stevens Institute, in the early nineties, by entering the employ of the Sprague Elevator Company. In the following years he was successively draftsman, chief draftsman, shop superintendent, construction superintendent and general superintendent of construction for the Sprague Elevator Company and its subsidiary, the Metropolitan Electric Construction Company. When in 1898 the principal elevator companies, including the Sprague, were combined under the corporate title of the Otis Elevator Company, Mr. Gurney was appointed assistant superintendent of construction, and later general superintendent of construction in charge of all work east of Chicago, including not only electric machines, but also hydraulic, plunger, steam and belted. Among the notable installations made under his direction were those in the Broad Exchange, Metropolitan Life and Park Row Buildings and the Waldorf-Astoria Hotel, in New York. In 1905 he acquired the controlling interest in the National Elevator & Machine Company, of Honesdale, Pa., one of the few independent elevator companies in existence at that time, and immediately proceeded to develop a line of electric elevators, his long experience in both the manufacturing and construction departments of the elevator business fitting him for detecting and remedying weak features common to electric elevators generally. For direct-current work he adopted the costly interpole motor, the mechanical controlling devices were abandoned and electric operating devices substituted. Gurney elevators met at once with success and a number of important buildings have been equipped with them, including the new buildings of the Equitable Life Assurance Society, the Trinity Church corporation, the Bush Terminal Warehouses and the Chelsea Docks.

H. F. GURNEY.

Obituary.

MR. N. WETMORE HALSEY, of the financial house of N. W. Halsey & Company, of New York, Chicago and other cities, died in New London, Conn., on July 1. Mr. Halsey organized the banking firm which bears his name, and, as it was a prominent dealer in the bonds of public-utility corporations, he enjoyed a considerable acquaintance among electrical men. Mr. Halsey was a director of the Electrical Utilities Company, the Netherlands Tramways Corporation and the Pacific Gas & Electric Company. Before organizing his own business he was for many years the resident partner in New York City for N. W. Harris & Company.

Trade Publications.

TRAIN-LIGHTING CONNECTORS.—The Delta-Star Electric Company of Chicago has issued pages 11-14 of its sectional catalog, which contain a complete description of the automatic and non-automatic Gibbs type train connectors for use in steam-railroad train lighting.

ELECTRIC BUFFING LATHES.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued Bulletin No. 3709, replacing Bulletin No. 3707 on electric buffing lathes for direct and alternating currents. The lathes for direct-current circuits have internal speed-regulating coils connected to the switch, giving three running speeds of approximately 1600, 2400 and 3400 r.p.m. The alternating-current lathes operate at one speed only.

BUSINESS NOTES.

THE HOLOPHANE COMPANY, NEW YORK OFFICE.—The New York office of the Holophane Company has been moved to 16 East Fortieth Street.

INDIAN REFINING COMPANY.—After July 1 the general and executive offices of this company will be located permanently in the Whitehall Building at 17 Battery Place, New York.

BOSTON HOLOPHANE OFFICE MOVES.—The Boston office of the Holophane Company, in charge of Mr. H. C. Jones, moved into new quarters on June 26. The new address is 10 High Street, where both the office and stockroom are now located.

SANGAMO CHICAGO OFFICE.—The Sangamo Electric Company, Springfield, Ill., announces that after July 1 its Chicago office will be located at 617-631 West Jackson Boulevard, occupying joint offices with the Delta-Star Electric Company, whose president, Mr. H. W. Young, is also manager for the Sangamo company.

PITTSBURGH TRANSFORMER WESTERN AGENCY—The Pittsburgh Transformer Company announces that its Western sales agency will, from July 1, be conducted by the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill. The Western agency was formerly held by the Republic Electric Company, controlled by stockholders of the Delta-Star Electric Company. The officers of the Delta-Star Electric Company are H. W. Young, president, and A. S. Pearl, secretary.

PUBLIC SPIRIT IN FT. WAYNE WORKS.—The Ft. Wayne Electric Works of the General Electric Company, Ft. Wayne, Ind., maintain a volunteer fire department of thirty men. This department is a member of the Northeastern Indiana Volunteer Firemen's Association, which held its annual reunion June 29 at Winchester. The department from the Ft. Wayne Electric Works with the Electrotechnic Band, also from the same company, won first prize for appearance in the parade. Three men from the department won first prize in the water battle and the hose team won first prize in the hose-laying contest from eleven contestants. The Electrotechnic Band, in order to make a clean sweep of it, won first prize that evening in the band contest from the best bands in the State. Organizations of this character do much to increase "team spirit" at the Ft. Wayne Electric Works, and an outing of this kind once in a while is greatly appreciated by both the fire department and the band.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 4, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

996,491. MAGNETIC PREPARATION OF ORES; A. A. Lockwood, London, England. App. filed April 14, 1911. Magnetite, oil and K_2S are added, the ore and the mixture separated in a wet magnetic separator.

996,606. GROUNDING CLAMP; M. H. Bodley and F. T. Kleffman, Altoona, Pa. App. filed Nov. 21, 1910. A continuous U-strip of sheet metal with recesses for the wires and bolts connecting the upper and lower portions.

996,615. ELECTRIC SWITCH; H. J. Carrigan, Buffalo, N. Y. App. filed Aug. 9, 1909. An annular row of fixed contacts, a rotatable contact arm and a rotatable baffle to prevent tampering with the switch by unauthorized persons; as in automobile ignition systems.

996,618. FIRE ALARM; A. W. Comrack, Olyphant, Pa. App. filed June 12, 1909. An audible signal is operated by a switch actuated by a motor set in operation by rise in temperature,

996,676. SECONDARY BATTERY; G. I. Rawson and L. B. Shultz, St. Louis, Mo. App. filed Jan. 9, 1911. A block of insulating material forms a cap for the container and is held in place by a plastic seal.

996,701. AUTOMATIC CUT-OUT FOR AERIAL TELEPHONE LINES AND THE LIKE; L. W. Carroll, Anamosa, Ia. App. filed May 24, 1907. An impedance coil in circuit with the parts of a divided conductor and a resistance in shunt affected by hygrometric conditions.

996,713. FREQUENCY-MEASURING INSTRUMENT; R. Hartmann-Kempf, Frankfort-on-the-Main, Germany. App. filed May 31, 1907. The current impulses vibrate resounding bodies tuned to different periodicities. A permanent magnet counteracts one set of alternating magnetic impulses.

996,755. TRANSFORMER; C. Le G. Fortescue, Wilkinsburg, Pa. App. filed July 6, 1908. Laminated terminal-supporting bridges extend between laminated insulating barriers between the coils.

996,758. ELECTRIC HEATING DEVICES; W. S. Hadaway, East Orange, N. J. App. filed July 24, 1908. Improvement in 890,856 sadiron. The heating element is a ribbon disposed as a flattened double helix.

996,762. ELECTRIC MACHINERY; K. Hertwig and F. Collischonn, Frankfort-on-the-Main, Germany. App. filed May 6, 1903. Fluctuations of the current supplied to colliery winding machines are compensated for so that the work is stored and later used.

996,764. PRIMARY BATTERY; C. E. Hite, Burlington, N. J., App. filed Aug. 16, 1906. The combination of two receptacles, one of which is divided into compartments by plate electrodes.

996,770. COMBINED TELEPHONE AND ELECTRIC LAMP; F. J. Kerbel, New York, N. Y. App. filed March 27, 1908. A stand with a bell-like lamp shade and having a telephone transmitter within the bell.

996,782. INSULATOR; W. S. Moore, Princeton, Ill. App. filed Nov. 22, 1910. A block with grooves above and below for cross-line wires, and tie wires extending through holes in the block.

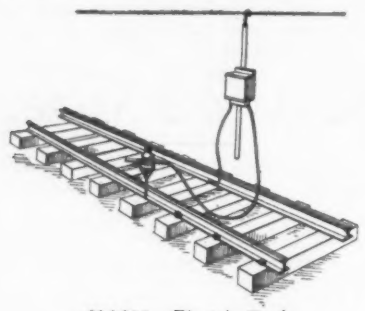
996,804. ALARM INDICATOR FOR BOILING PURPOSES; G. Schumacher, Wermelskirchen, Germany. App. filed Nov. 22, 1906. To avoid overboiling of milk, etc. The alarm device is supported by means decomposed by moist steam.

996,822. BRIDGING BLOCK FOR DYNAMO-ELECTRIC MACHINES; F. W. Young, East Orange, N. J. App. filed April 21, 1910. A core of magnetic material with an insulating covering and an enveloping helix of magnetic material.

996,833. ELECTRIC TOOL; C. B. Coates, Chicago, Ill. App filed July 20, 1908. A pilot switch on the drill, etc., under control of the operator's hand, controls a larger main switch supported independently of the tool.

996,848. VAPOR-RECTIFIER SYSTEM; C. M. Green, Lynn, Mass. App. filed Aug. 11, 1905. A mercury-vapor rectifier has its anodes connected to alternating-current terminals and its load circuit connected to a point on the alternating-current source. The alternating-current voltage is varied by means responsive to the direct current in the load circuit.

996,849. ARC LAMP; G. M. Guerrant, Danville, Va. App. filed April 15, 1910. The electrodes are rotatable circular disks on axes at an angle to each other and bodily movable in intersecting planes to maintain an arc in a fixed position.



996,833.—Electric Tool.

996,851. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed Oct. 8, 1910. Oil-immersed type for use in manholes of underground cable systems. Cable outlets and operating lever may be independently turned to any angle for convenience.

996,853. TERMINAL FOR ELECTRIC WIRES; G. L. Herz, New York, N. Y. App. filed Feb. 10, 1910. A spring yoke with convex adjacent faces (attached to a spark plug, etc.) and a screw eye (on the conductor cord) to engage the yoke rotatably.

996,854. AUTOMATIC ELECTRICALLY GOVERNED ENGINE-CONTROLLING APPARATUS; H. D. Hinckley, Hartford, Conn. App. filed Oct. 20, 1910. A starting and stopping valve is operated by an electric motor and controller.

996,862. ELECTRIC REGISTER; R. Kraus, Hamilton, Ontario, Canada. App. filed July 14, 1910. Alternate conducting plates and resistance members of constant specific conductivity are arranged in groups separated by non-conductors and yieldingly supported; for heating rooms, etc.

996,865. VAPOR ELECTRIC APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Jan. 9, 1904. A plurality of inclined condensing chambers minimize the impact caused by the return of the products of condensation.

996,874. RELAY; W. W. Moak, Schenectady, N. Y. App. filed Oct. 21, 1908. The stationary contact is so mounted that it cannot be thrown out of adjustment without breaking the seal and opening the casing which contains the movable contact.

996,876. JUNCTION BOX; M. J. Myers, Syracuse, N. Y. App. filed Nov. 26, 1907. Closures for the outlets in an insulating cap are held in place by a thin glaze readily breakable.

996,878. INSULATING BUSHING; L. C. Nichols, Milwaukee, Wis. App. filed Oct. 25, 1909. A series of flat disks are held together by parallel axially extending members and separated from the central conductor by a spiral of paper and an insulating liquid.

996,883. DYNAMO-ELECTRIC MACHINE; H. C. Reist, Schenectady, N. Y. App. filed March 1, 1905. A cast spider for the revolving member with ventilating and stiffening portions.

996,894. SYSTEM OF ELECTRICAL DISTRIBUTION; E. W. Stull, Milwaukee, Wis. App. filed July 18, 1908. A variable voltage circuit, a generator armature in a second circuit supplied from the first and a Wheatstone bridge arrangement connected for varying and reversing the generator voltage.

996,895. COMMUTATOR FOR ELECTRIC MACHINES; W. S. Sutton, Madison, Wis. App. filed Sept. 23, 1907. The commutator bars are spaced apart and supported by a plurality of internal supporting rings with a fusible insulating enamel bond between the rings and bars.

996,927. ARMATURE CORE; J. D. Ihlder, New York, N. Y. App. filed Dec. 8, 1904. Laminations combined with spacing disks of successively reduced diameters separated by air spaces.

996,936. APPARATUS FOR EVACUATING INCANDESCENT-LAMP BULBS; J. R. Massey, Cleveland, Ohio. App. filed Dec. 20, 1905. Automatic machine. Bulbs simultaneously heated and exhausted. A series of bulbs are contemporaneously in different stages of evacuation. (Fifty claims.)

996,951. METHOD OF AND APPARATUS FOR DEVIATING ELECTRIC ARCS; J. J. Thoresen and F. Tharaldsen, Norway. App. filed Feb. 16, 1905. A rotary magnetic field deviates the arc and a current of gas is passed through the arc, for instance, as in the production of nitrogen and oxygen compounds from air.

996,960. END-CELL SWITCH; J. M. Andersen, Boston, Mass. App. filed Dec. 20, 1910. A circuit controller is moved step by step to add or subtract cells to or from a storage battery in a central power station.

996,973. SWITCH; C. E. Carpenter, New York, N. Y. App. filed May 9, 1907. Electromagnetically operated; double break with blow-out; a part of the magnetic circuit of the blow-out magnet is formed by the armature of the operating magnet.

996,975. RECTIFIER SYSTEM; A. Churchward, New York, N. Y. App. filed Oct. 14, 1907. An auxiliary arc is produced in the rectifier by means of a storage battery when the main-load current reaches or approaches the instability point of operation.

996,979. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed April 21, 1904. A circuit controller in the tube (lamp) is actuated by the bombardment of the vapor particles in the arc path.

996,990. ELECTRIC CIRCUIT CLOSER; C. F. Lewis, New York, N. Y. App. filed May 31, 1906. A casing to be carried, for instance, by an elevator car and having pivoted arms with projecting brushes

997,012. APPARATUS FOR CHECKING THE USE OF TELEPHONES; O. Schmid, Heilbronn, Germany. App. filed Feb. 10, 1911. A strip of record paper is fed by the movement of a locking device for the receiver hook.

997,036. BURGLAR ALARM; C. E. Blackburn, Hodge, La. App. filed Dec. 15, 1910. A spring-pressed plunger switch released by the opening of a door or window.

997,042. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed July 3, 1909. Porcelain distributor formed in two parts.

997,043. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed July 15, 1909. Closed-head type, of two porcelain halves having extended edges for fanning strips.

997,044; ARC SOLDERING IRON; M. Danko, South Bethlehem, Pa. App. filed Oct. 22, 1910. The head contains a shell insulated from it and containing arc terminals.

997,054. PENDENT ELECTRICAL SWITCH; W. J. Gagon, Bridgeport, Conn. App. filed Sept. 4, 1908. Two-button push type with special shaped "porcelain."

997,066. DEVICE FOR INSULATING THE TWISTED ENDS OF ELECTRIC WIRES; J. Krannichfeldt, Cologne, Germany. App. filed Nov. 22, 1910. A water-tight filled tube for protection in electric ignition of explosives in moist earth.

997,070. BACTERIOLOGICAL OVEN OR INCUBATOR; H. L. Lowe, Pittsburgh, Pa. App. filed Aug. 22, 1908. The heating resistances are normally in parallel, but are thrown in series to reduce heat by the action of a thermostat in a surrounding water jacket.

997,085. ANTISTATIC FRICTION DEVICE; J. J. O'Toole, New York, N. Y. App. filed March 4, 1910. A number of metal brushes extend across a lithographing or printing press to extract the static electricity from the paper.

997,087. INSULATED PIPE JOINT OR COUPLING; S. E. Peeples, Washington, D. C. App. filed Oct. 16, 1910. Socket and nipple members are secured together with insulation so as to prevent condensation from the short-circuiting.

997,106. ELECTRIC SWITCH; J. C. Walden, Mystic, Ia. App. filed April 5, 1910. Devices carried by a street-railway car operate the track switch on the approach of a car from either direction.

997,135. TROLLEY; W. W. Irwin, El Paso, Tex. App. filed Nov. 23, 1910. Two angularly disposed wheels, forming a passage between their flanges for the wire.

997,155. LAMP REGULATOR; E. H. Smith, Aberdeen, Wash. App. filed Oct. 18, 1910. For varying the luminosity of an incandescent electric light. Has a ventilated rheostat ring to prevent overheating.

997,165. TROLLEY; I. Widowicki, Jersey City, N. J. App. filed April 5, 1911. Spring-pressed guide arms are pivoted on the ends of the usual wheel and have rollers on their upper ends.

997,194. ELECTRIC HEATER; B. G. Jamieson and C. A. Keller, Chicago, Ill. App. filed May 4, 1909. A helical conductor is embedded in waterproof cement.

997,215. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS; J. B. Strubble, Wilkinsburg, Pa. App. filed March 11, 1909. For alternating-current work. Signaling currents in the track circuits are supplied from one generator and relay currents are supplied from a second.

997,224. CIRCUIT CONTROLLER; C. W. Yerger, Milwaukee, Wis. App. filed Nov. 4, 1909. Two automatic switches and a master controller.

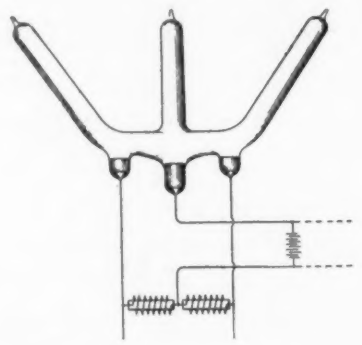
997,230. AUTOMATIC-ALARM DRIP PAN; J. F. C. Bendt, Baltimore, Md. App. filed Jan. 16, 1911. A float-operated device for refrigerators, etc.

PATENTS ISSUED JUNE 13, DELAYED IN RECEIPT.

994,854. INCANDESCENT-LAMP LOCK; A. O. Mackin, Johnstown, Pa. App. filed July 21, 1910. An attachment having spring wire coils to bind in an ordinary socket and a spring to hold an ordinary lamp.

994,980. ELECTRICAL RECEPTACLE; J. S. Crossley, Solvay, N. Y. App. filed Nov. 18, 1909. For incandescent lamps and plugs and may be connected and disconnected to line wires in an outlet box without drawing out the wires.

995,100. ELECTRIC HAND LAMP; H. Siegenbruch, Heissen, Germany. App. filed April 29, 1910. The handle has ball bearings, to permit the lamp to turn freely and thus avoid twisting the lamp cord.



996,865.—Vapor Electric Apparatus.

PATENTS ISSUED JUNE 27. DELAYED IN RECEIPT.

996,580. WIRELESS TELEGRAPHY; C. M. Green, Lynn, Mass. App. filed Sept. 30, 1907. A multiplex system using multiphase current. Maintained periodic electromagnetic waves of ineffective volume are reinforced in accordance with the desired signals.

996,582. STATIC PROTECTOR FOR VAPOR ELECTRIC APPARATUS; J. L. Hayden, Schenectady, N. Y. App. filed Jan. 5, 1906. A good conducting shell surrounds one of the electrodes and is connected to its supply lead to prevent deterioration and arcing.

996,583. ELECTROLYTE FOR ELECTROLYTIC CELLS; J. L. R. Hayden, Schenectady, N. Y. App. filed March 5, 1908. Solution of ammonium octoborate with glycerine or milk sugar for high voltage, moderate temperature rise and inappreciable deterioration.